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THE DEPARTMENT OF ENERGY FISCAL YEAR 2012 RESEARCH AND DEVELOPMENT BUDGET REQUEST

HEARING

BEFORE THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

MARCH 3, 2011

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CONTENTS

March 3, 2011

Page
Witness List 2
Hearing Charter 3

Opening Statements

Statement by Representative Ralph M. Hall, Chairman, Committee on Science, Space, and Technology, U.S. House of Representatives 10
    Written Statement 11
Statement by Representative Eddie Bernice Johnson, Ranking Minority Member, Committee on Science, Space, and Technology, U.S. House of Representatives 11
    Written Statement 13

Witness:

Dr. Steven Chu, Secretary, Department of Energy

    Oral Statement 14
    Written Statement 16
    Biography 32
Discussion 33

Appendix I: Answers to Post-Hearing Questions

Dr. Steven Chu, Secretary, Department of Energy 80

Appendix II: Additional Material for the Record

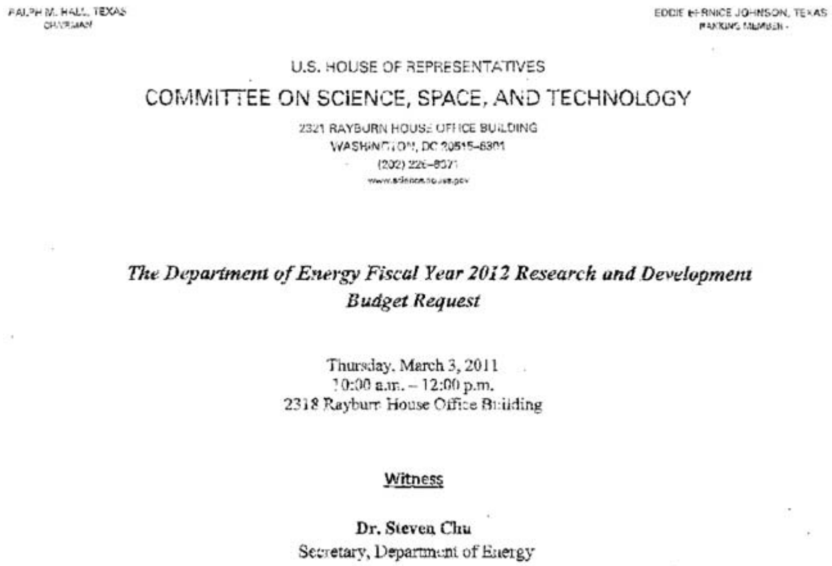
Submitted Materials of Ranking Member Johnson, Committee on Science, Space, and Technology, U.S. House of Representatives 282
Submitted Statement of Representative Jerry Costello, Committee on Science, Space, and Technology, U.S. House of Representatives 286

THE DEPARTMENT OF ENERGY FISCAL YEAR 2012 RESEARCH AND DEVELOPMENT BUDGET REQUEST

THURSDAY, MARCH 3, 2011

House of Representatives,
Committee on Science, Space, and Technology,
Washington, DC.

The Committee met, pursuant to call, at 10:05 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Ralph Hall [Chairman of the Committee] presiding.



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COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
2321 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-6301
(202) 225-6371
www.science.house.gov

The Department of Energy Fiscal Year 2012 Research and Development Budget Request

Thursday, March 3, 2011
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witness

Dr. Steven Chu
Secretary, Department of Energy

HEARING CHARTER

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

The Department of Energy Fiscal Year 2012 Research and Development Budget

THURSDAY, MARCH 3, 2011
10:00–12:00
2318 RAYBURN HOUSE OFFICE BUILDING

PURPOSE

On Thursday, March 3, 2011, the Committee on Science, Space, and Technology will hold a hearing entitled "The Department of Energy Fiscal Year 2012 Research and Development Budget." The purpose of the hearing is to receive testimony from the Secretary of Energy on the President's Fiscal Year (FY) 2012 budget request for energy research and technology development programs at the Department, including activities under the Office of Science, Energy Efficiency and Renewable Energy, Advanced Research Projects Agency-Energy, Fossil Energy, Nuclear Energy, Electricity Delivery and Energy Reliability, and the Loan Guarantee Program Office.

WITNESS

Dr. Steven Chu, U.S. Secretary of Energy. Dr. Chu was confirmed as the 12th Secretary of Energy on January 20, 2009. Prior to his appointment Dr. Chu was the Director of DOE's Lawrence Berkeley National Laboratory, and a professor of Physics and Molecular and Cell Biology at the University of California. He was the co-winner of the 1997 Nobel Prize for Physics.

Department of Energy (DOE) Spending

(dollars in millions)

Program	FY08 Actual	FY10 Enacted	FY11 Request	FY11 CR*	FY12 Request	FY12 Request versus FY10 Enacted	
						$	%
Office of Science							
Advanced Scientific Computing Research	*351.0*	*383.2*	*426.0*	-	*465.6*	*82.4*	*21.5*
Basic Energy Sciences	*1270.0*	*1599.0*	*1835.0*	-	*1985.0*	*386.0*	*24.1*
Biological and Environmental Research	*544.0*	*588.0*	*627.0*	*302.0*	*717.9*	*129.9*	*22.1*
Fusion Energy Sciences	*287.0*	*417.7*	*380.0*	-	*399.7*	*(18.0)*	*(4.3)*
High Energy Physics	*689.0*	*790.8*	*829.0*	-	*797.2*	*6.4*	*0.8*
Nuclear Physics	*433.0*	*522.5*	*562.0*	-	*605.3*	*82.8*	*15.9*
Office of Science	**4083.0**	**4964.0**	**5121.0**	**4017.7**	**5416.0**	**452.0**	**9.11**
Energy Efficiency and Renewable Energy (EERE)							
Hydrogen Technology	*211.1*	*170.3*	*0.0*	-	*0.0*	*(170.3)*	*(100)*
Hydrogen and Fuel Cell Technologies	*0.0*	*0.0*	*137.0*	-	*100.5*	*100.5*	*n/a*
Biomass and Biorefinery Systems	*198.2*	*216.2*	*220.0*	-	*340.5*	*124.3*	*57.5*
Solar Energy	*168.5*	*243.4*	*302.4*	-	*457.0*	*213.6*	*87.8*
Wind Energy	*49.6*	*79.0*	*122.5*	-	*126.9*	*47.9*	*60.6*
Geothermal Technology	*19.8*	*43.1*	*55.0*	-	*101.6*	*58.5*	*135.7*
Water Power	*9.9*	*48.7*	*40.5*	-	*38.5*	*(10.2)*	*(20.9)*
Vehicle Technologies	*213.0*	*304.2*	*325.3*	-	*588.0*	*283.8*	*93.3*
Building Technologies	*109.0*	*219.0*	*230.7*	-	*470.7*	*251.7*	*114.9*
Industrial Technologies	*64.4*	*94.3*	*100.0*	-	*319.8*	*225.5*	*239.1*
Energy Efficiency and Renewable Energy (EERE)	**1704.0**	**2242.5**	**2355.0**	**1467.4**	**3200.0**	**957.5**	**42.70**
Nuclear Energy R&D	**438.0**	**487.0**	**396.0**	**661.1****	**447.4**	**(39.6)**	**(8.1)**
Electricity Delivery and Energy Reliability R&D	**82.8**	**168.5**	**144.3**	**139.0**	**192.8**	**24.3**	**14.4**
Fossil Energy R&D	**888.5**	**659.3**	**760.0**	**586.6**	**453.0**	**(206.3)**	**(31.3)**
ARPA-E	**n/a**	**0.0**	**300.0**	**50.0**	**650.0*****	**650.0**	**n/a**
Loan Guarantee Program Office	**4.6**	**0.0**	**0.0**	-	**305.0**	**305.0**	**n/a**
Totals:	**7200.9**	**8521.3**	**8776.3**	**6921.8**	**10014.2**	**1492.9**	**14.9**

*as passed by the House on February 12

**Includes the entire Office of Nuclear Energy

***$100 million of the $650 million ARPA-E request is proposed to be paid for through revenues collected from auction of wireless broadcast spectrum.

BACKGROUND

The Department of Energy (DOE) funds a wide range of research, development, demonstration, and commercial application activities. DOE's primary mission is to "advance the national economic, and energy security of the United States; to promote scientific and technological innovation in support of that mission; and to ensure the environmental cleanup of the national nuclear weapons complex." [1] In order to fulfill its mission, DOE operations are guided by five strategic themes: energy security, nuclear security, scientific discovery and innovation, environmental responsibility, and management excellence.

The overall FY 2012 budget request for DOE is $29.5 billion, which represents a $3.1 billion or 11.8 percent increase over FY 2010 levels. Approximately one third of this amount is dedicated to programs within the Committee on Science, Space, and Technology's jurisdiction. The balance of DOE's funding is allocated to the National Nuclear Security Administration (NNSA), to maintain our stockpile of nuclear weapons, and Defense and Non-Defense Environmental Management (EM) programs, to manage the cleanup of nuclear weapons production and government-sponsored nuclear energy research.

DOE R&D PROGRAMS AND OFFICES

Office of Science

The total FY 2012 budget request for the Office of Science (SC) is $5.4 billion, a $452 million or 9.1 percent increase over the FY 2010 levels. The mission of the Office of Science is the delivery of scientific discoveries, capabilities, and major scientific tools to transform the understanding of nature and to advance the energy, economic, and national security of the United States. In support of this mission, SC supports basic research in the following areas: advanced scientific computing, basic energy sciences, biological and environmental research, fusion energy sciences, high energy physics, and nuclear physics. SC's operations take place in three main areas: selection and management of research; operation of world-class, state-of-the-art scientific facilities; and design and construction of new facilities. SC also supports several ongoing interagency initiatives such as the Networking and Information Technology Research and Development program; the National Networking Initiative; the United States Global Change Research Program; and the Climate Change Technology Program. SC provides 45 percent of Federal support of basic research in the physical sciences and key components of the Nation's basic research in biology and high-end computing.

Office of Science budget and activities are divided into the following six major program areas:

Basic Energy Sciences (BES) requests $1.99 billion, an increase of $386 million (or 24.1 percent) over FY 2010 levels. BES supports basic research into the fundamental building blocks necessary for advancing new energy technologies, and maintains world-class research facilities to develop new knowledge and facilitate advances in areas such as materials science and chemistry.. The FY 2012 budget reiterates the FY 2011 request for $34 million to fund a new Batteries and Energy Storage Energy Innovation Hub. Additionally, the existing Fuels from Sunlight Hub requests $24.3 million.

In order to realize significant research gains and advance new research methodology, in 2009 BES initiated the creation of Energy Frontier Research Centers (EFRCs.) EFRCs are individually funded between $2-5 million per year to conduct focused research from a small team to solve "grand challenges" associated with disruptive scientific advances. DOE requests continued funding of all 46 existing EFRCs in FY 2012.

Biological and Environmental Research (BER) requests $717.9 million in the President's budget, which is $129.9 million (22.1 percent) over FY 2010 funding. BER examines fundamental biological systems, climate, and environmental sciences. Specifically, BER researches genomics, drivers of climate change, and deeper environmental issues. The request also includes support for the three DOE Bioenergy Research Centers, the Joint Genome Institute, and Environmental Molecular Sciences Laboratory.

BER is also a major contributor to the ***Intergovernmental Panel on Climate Change (IPCC)*** by providing expertise in climate modeling and simulations. The FY 2012 budget request includes notable funding increases for BER given pending work on the IPCC's Fifth Assessment.

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[1] All DOE mission statement quotes come from the cited office's website.

The budget would provide $465.6 million for ***Advanced Scientific Computing Research (ASCR)***, an increase of $82.4 million (21.5 percent) over FY 2010 levels. A sizable portion of the increase is slotted for National Leadership Computing Facilities, the nation's most powerful open resource for capability computing located at Oak Ridge National Laboratory and Argonne National Laboratory. Continued investigation of a potential exascale computing project to increase computational capacity by a thousand-fold accounts for the remainder of the requested additional funds.

The request for ***Fusion Energy Sciences (FES)*** is $399.7 million, a decrease of $18 million (4.3 percent) below FY 2010 funding. FES supports research to improve fundamental understanding of matter at very high temperatures and densities needed to develop fusion energy. The contribution to the international ITER project, a partnership to demonstrate the first fusion prototype, would be reduced by $30 million.

The FY 2012 funding request for ***High Energy Physics (HEP)*** is $797.8 million, a $6.4 million (0.8 percent) increase from the enacted FY 2010 level. HEP probes the basic relationship between space and time, the elementary constituents of matter and energy, and the interactions between them. This effort is concentrated on three scientific frontiers: the energy frontier, the intensity frontier, and the cosmic frontier.

Nuclear Physics (NP) would receive $605.3 million, an increase of $82.8 million (15.9 percent) over FY 2010 funding. This program supports research to discover and understand various forms of nuclear matter. It also supports the production and development of techniques to make isotopes that are in short supply for medical, national security, environmental, and other research applications.

Energy Efficiency and Renewable Energy

The mission of the Office of Energy Efficiency and Renewable Energy (EERE) is to "strengthen the United States' energy security, environmental quality, and economic vitality in public-private partnerships." EERE supports this mission statement by: "Enhancing energy efficiency and productivity; bringing clean, reliable and affordable energy technologies to the marketplace; and making a difference in the everyday lives of Americans by enhancing their energy choices and their quality of life." EERE participates in many crosscutting activities with other departments, as well as within DOE offices, including collaborations with the Office of Science, the Advanced Research Projects Agency - Energy, Office of Electricity, Fossil Energy, Federal Energy Management Program, and the Loan Guarantee Program Office.

The Administration's budget request of $3.2 billion for EERE represents a $958 million (44.4 percent) increase over FY 2010 levels. This reflects the President's call in his State of the Union speech for increased spending on clean energy technologies. The budget requests significant funding increases for most EERE programs relative to the FY10 enacted level. Additionally, EERE is increasing the number of staff in their Washington, DC headquarters, while decreasing field FTEs.

The proposed funding for the ***Solar Energy*** program is $457 million, an increase of $213.6 million (87.8 percent) over FY 2010 levels. This request intends to fund the "SunShot" initiative recently proposed by the Administration. As a part of this initiative, EERE is advancing a "Dollar-a-Watt" program to make solar energy to be cost-competitive with fossil fuels without subsidies. To achieve this goal, solar generation needs to reach a four to five cents/kWh equivalent installed price for solar photovoltaics (PV) energy by 2020, or reduce the installed cost of solar electricity by approximately 75 percent from current costs. Accordingly, an overwhelming percentage of solar energy's increased funding is directed to the PV subprogram. EERE will also continue to fund the Concentrating Solar Power (CSP) subprogram for further research in CSP development and thermal storage activities. As a means to accelerate widespread market adoption of solar energy, the program also seeks to improve applicable local codes, permitting, education and training.

The FY 2012 funding request for the ***Wind Energy*** program is $126.9 million, an increase of $47.8 million (60.6 percent) over FY 2010 levels. The request continues funding a demonstration project to develop offshore wind technology, and aims to address financial, regulatory, technical, environmental, and social issues associated with offshore wind.

The FY2012 ***Biomass and Biorefinery Systems*** budget request is $340.5 million, an increase of $124.3 million (57.5 percent) over the FY 2010 level. This program aims to develop and transform domestic, renewable, and abundant biomass resources into cost-competitive, high performance biofuels, biopower, and bioproducts through targeted planning, research, development and demonstration. In FY 2012, funding for feedstock production trials will be eliminated. The elimination is offset by a major increase of $150 million to expand the Cellulosic Biofuels Reverse Auction with the intention of rapidly injecting money into the emerging cellulosic biofuels industry. Support for integrated biorefinery projects also notably decreases with increased focus on R&D for downstream deployment efforts.

The proposed funding level for the ***Geothermal Technology*** program is $101.5 million, an increase of $58.4 million (135.5 percent) over FY2010. This program seeks to broaden its focus to include technologies with a near–term impact by confirming undiscovered hydrothermal resources with innovative exploration technologies. Additionally, the Enhanced Geothermal Systems subprogram is aiming to advance new technologies to use waste carbon dioxide to capture heat and make electricity.

The Administration's budget request provides a total of $38.5 million for the ***Water Power*** program, which is a $10.2 million (20.9 percent) decrease from FY 2010 enacted levels. The program funds incremental hydropower development and demonstrates marine and hydrokinetic (MHK) technologies. The funding will support full-scale MHK open water demonstration projects to establish the baseline cost of MHK generated electricity by 2013.

The ***Hydrogen and Fuel Cell Technologies (HFCT)*** program requests $100.5 million; a $70 million or 41 percent decrease from FY 2010 levels. The decrease reflects EERE refocusing of specific R&D on fuels cells for stationary, transportation and portable power applications.

The budget request for the ***Buildings Technologies Program (BTP)*** is $470.7 million, a $252 million (114.9 percent) increase over FY 2010 levels. BTP supports efforts to improve the energy efficiency of new and existing homes and buildings primarily through advanced building technologies, controls, systems, and whole-building design; demonstration of integrated approaches for construction; bringing transformational tools to the market place; supporting the ENERGY STAR program; supporting the adoption, training, and enforcement of building codes; and promulgating and finalizing efficiency standards as required by law. The Energy Efficient Buildings Systems Design Hub is administered by BTP.

BTP's FY 2012 request includes the President's new *Better Buildings Initiative,* which aims to achieve a 20 percent improvement in commercial building energy efficiency by 2020. In addition to increased R&D funding for building technologies, the initiative includes new tax incentives for commercial building energy efficiency projects and financing opportunities for state and municipal governments through the "Race to the Green" competitive grant program. The initiative would also receive funding from the Loan Guarantee Program Office.

The***Vehicle Technologies Program (VTP)*** requests $588 million, an increase of $283 million (93 percent) over the FY 2010 level. The increase reflects an emphasis on the development and deployment of plug-in hybrid vehicles (PHEVs). Specifically, in support of the President's goal to place one million electric vehicles on the road by 2015, VTP is requesting $229 million proposing to fund infrastructure development for transportation electrification, including a major new program of grants to communities for upgrading electric vehicle infrastructure.

The Industrial Technologies Program (ITP) request is $319.8 million, an increase of $225.5 million (239.2 percent) over FY2010 levels. ITP seeks to revolutionize industry's energy and carbon intensity by developing manufacturing technologies, materials, and clean energy manufacturing capacity. The Next Generation Materials and Next Generation Manufacturing Processes subprograms are both drastically increased to assist in attaining this goal. Additionally, the request proposes the creation of an Energy Innovation Hub on critical materials. A new $50 million Energy Efficiency Partnership is included to assist industry incorporation of energy efficient technologies into existing facilities.

The Advanced Research Projects Agency -Energy (ARPA-E)

The Administration requests $650 million for the Advanced Research Projects Agency - Energy (ARPA-E).

Established in 2007 by the America COMPETES Act (P.L.110-69), ARPA-E is statutorily charged with developing energy technologies that result in "(i) reductions of imports of energy from foreign sources; (ii) reductions of energy-related emissions, including greenhouse gases; and (iii) improvement in the energy efficiency of all economic sectors." Initially provided with $400 million in American Recovery and Reinvestment Act (ARRA) (P.L.111-5) funding, ARPA-E did not receive a direct appropriation in FY10, though it was the beneficiary of a $15 million transfer from the Office of Science.

Of the $650 million request, $550 million would be provided through discretionary funding for the purpose of sponsoring additional rounds of project funding. Potential funding areas include stationary power, electrical infrastructure, end use efficiency, embedded efficiency, and transportation systems.

ARPA-E would also administer an additional $100 million Wireless Innovation Fund (WIN) aimed at developing clean-energy wireless technologies, paid for through a proposed transfer of wireless spectrum auction revenues. The Administration proposes to establish WIN as a mandatory program. In 2010, ARPA-E issued $207.6 million in ARRA funds for 85 projects. The six program areas funded in 2010 included Electrofuels, Batteries for Electrical Energy Storage in Transportation (BEEST), Innovative Materials & Processes for Advanced Carbon Capture Technologies (IMPACCT), Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS), Agile Delivery of Electrical Power Technology (ADEPT), and Building Energy Efficiency Through Innovative Thermodevices (BEET-IT).Fossil Energy R&D

The DOE Office of Fossil Energy (FE) supports R&D focused on coal (including clean coal technologies), gas, and petroleum and also supports the Federal government's Strategic Petroleum Reserve. The President's total budget request for FE is $520 million. Of that, FE's R&D budget is $453 million, a decrease of $206 million (31.3 percent) below FY10 enacted levels. Coal R&D is funded at $291 million, the bulk of which focuses on advancing carbon capture and sequestration (CCS) efforts. Carbon capture research reprioritizes research from pre-combustion capture towards post-combustion technologies with the intention of advancing the development of commercial technology. The Carbon Storage subprogram is conducting large-volume injection testing to examine the feasibility of long-term carbon storage. The Hydrogen from Coal, Coal to Coal Biomass to Liquids, and Solid Oxide Fuel Cells subprograms are all eliminated.

The FY12 budget request proposes to terminate the Natural Gas Technologies and Unconventional Fossil Energy Technologies programs, including the elimination of $50 million for the Ultra-Deep and Unconventional Natural Gas Other Petroleum Resources Research Program.

Nuclear Energy (NE)

The primary mission of the Office of Nuclear Energy (NE) is to "advance nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration as appropriate."

The FY12 budget request for NE R&D is $447.4 million, a $39.6 million (8.1 percent) decrease below FY 2010 levels. Approximately 74 percent of that request would be dedicated to the Fuel Cycle R&D and Reactor Concepts RD&D programs. The Fuel Cycle R&D program conducts research on the three basic fuel cycle technologies: once-through, modified-open, and full recycle. The Reactor Concepts RD&D program continues previous activities undertaken by the Generation IV Nuclear Energy Systems program, including the Next Generation Nuclear Plant project. In addition, advanced Small Modular Reactor (SMR) designs would be examined.

As reflected in the Administration's FY 2011 budget request, NE proposes to create the Nuclear Energy Enabling Technologies (NEET) program. The $97.3 million program would investigate crosscutting technologies and transformative breakthroughs applicable to multiple reactor concepts and fuel cycle technologies. NEET would also support the Modeling and Simulation Energy Innovation Hub, which seeks to create a "virtual" reactor by applying existing modeling and simulation capabilities. This would utilize modeling as a means to improve efficiency in existing reactors as well as inform new reactor designs.

The budget also proposes a SMR Licensing Technical Support Program to partner with industry to accelerate development and licensing of SMRs necessary for commercial deployment.

Electricity Delivery and Energy Reliability

The mission of the Office of Electricity Delivery and Energy Reliability (OE) is to "lead national efforts to modernize the electric grid; enhance security and reliability of the energy infrastructure; and facilitate recovery from disruptions to energy supply." Research and development within OE is funded at $193 million in the President's FY12 budget request. This reflects an increase of $71.4 million (58.8 percent) over FY10 levels.

OE's R&D programs focus on clean energy transmission and reliability, smart grid R&D, energy storage, and cyber security for energy delivery systems. OE concentrates on potential strains on the electric system as electric generation shifts towards low-carbon energy sources, specifically associated intermittency problems from wind and solar generation. The effects will require advanced grid modeling and extensive technological breakthroughs in energy storage. The President requests $20 million for the creation of a Smart Grid Technology and Systems Hub to be administered by OE within the Clean Energy Transmission and Reliability subprogram.

Also highlighted within the OE request is $57 million for the Energy Storage subprogram, a 319 percent increase above the FY 2010 level to support demonstrations for a new suite of grid level storage projects and further testing on prototype materials.

Loan Guarantee Program Office

The President's FY12 budget request for DOE's Loan Guarantee Program Office (LPO) is $200 million. Funds would be used as a credit subsidy for loans authorized under Section 1703 of the Energy Policy Act of 2005. The LPO did not receive an appropriation for credit subsidies in FY10. This level of appropriation would support an estimated $1 to $2 billion in loan guarantees to support energy efficiency and renewable energy activities.

Since its creation, the LPO has awarded over $17.6 billion for 18 projects, in a wide variety of areas such as solar and wind power generation and manufacturing, geothermal energy, and electricity transmission and energy storage.

In addition to the Title 17 loan guarantees, the President is requesting $105 million to create a Better Building Pilot Loan Guarantee Initiative for Universities, Schools, and Hospitals. This new program would fund loan guarantees to retrofit commercial buildings and would subsidize up to $2 billion in total loan principal.

Energy Innovation Hubs

The FY12 budget request proposes funding of $146 million for support six Energy Innovation Hubs, which are supported through the SC, EERE, and NE accounts. This would support the three existing Hubs and as well as the creation of three new Hubs, which the President highlighted in his recent State of the Union address. According to the Administration, Hubs are funded at approximately $25 million each annually and area intended to "advance highly promising areas of energy science and engineering from the early stage of research to the point where the technology can be handed off to the private sector." [2]

Existing Hubs include Fuels from Sunlight ($24.3 million, administered by the Office of Science, Basic Energy Services), Modeling & Simulation for Nuclear Reactors ($24.3 million, administered by the Office of Nuclear Energy), and Energy Efficient Building Systems Regional Innovation Cluster Initiative ($24.3 million, administered by EERE, Building Technologies Program)The newly proposed Hubs are Batteries and Energy Storage ($34 million, administered by the Office of Science, Basic Energy Sciences), Smart Grid Technology and Systems ($19.4 million, administered by OE, Clean Energy Transmission and Reliability Program), and Critical Materials ($20 million administered by EERE, Industrial Technologies Program).

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[2] http://www.energy.gov/hubs/

Chairman HALL. The Committee on Science, Space, and Technology will come to order. Good morning to all of you, and welcome to today's hearing entitled "The Department of Energy's Fiscal Year 2012 Research and Development Budget Request." In front of all of us are packets containing the written testimony, a biography and truth in testimony disclosure for today's witness, Energy Secretary Steven Chu. I want to welcome everyone here today for this hearing on the President's fiscal year 2012 budget request. Is everybody ready to roll? I will recognize myself for five minutes for an opening statement. I will take less than five minutes. We don't hold you to five minutes. We appreciate you being here very much, and you may want to enlarge on some things and you may not want to. That will be your decision.

I want to welcome everyone here today for the hearing on the President's fiscal year 2012 budget request for the Department of Energy. Now, this is the third time that Secretary Chu has appeared before this Committee, and I want to thank you and I want to thank all of you for your willingness to be here and meet with members on Department of Energy programs and priorities. This is also the third DOE budget that the President sent to Congress, so it is general priorities and our concerns with them should come as no surprise.

What is notable, however, is the degree to which the President is what I guess in a poker game you would call it double down, on his energy and climate agenda in light of the continued struggle in the economy, trillion-dollar deficits, rising gas prices and fuel supply concerns driven by Middle East turmoil.

The centerpiece of this legislation is the President's proposed requirement that the United States produce 80 percent of its electricity from "clean" sources by 2035. While I want to better understand how the Administration intends to reach this goal, and while I strongly support an "all of the above" approach to energy security, I am concerned that the plan entails spending that we really can't afford and taxes and regulations that would severely raise the cost of energy and harm, in my opinion and a lot of our opinions, our economy.

The merits of this proposal seem weakened further by the fact that even if such a transition to clean electricity were successful, its benefits in terms of the effect it could have on climate change appears negligible.

My concerns regarding misplaced energy policy priorities extend to the R&D budget as well. The fossil fuels that drive our economy and meet over 80 percent of our energy needs continue to be penalized in favor of cleaner alternatives, but that seems to continue. For example, the natural gas and unconventional fossil fuels technology programs are zeroed out while energy efficiency and renewable energy R&D programs would receive $1 billion, or a 44 percent increase above current levels. And these increases come on the heels of over $16 billion in stimulus funding and a near doubling of the EERE base budget since fiscal year 2006. I am also concerned that much of the clean energy spending is focused on late-stage technology development and commercialization more appropriately performed by the private sector.

The changes called for in this budget are not just trends, they represent dramatic shifts that warrant our close review and consideration in the coming weeks and months. While I have many concerns, I look forward to working with the Secretary, Ranking Member Mrs. Johnson and members of the committee to develop a thorough and constructive response to these proposals.

[The prepared statement of Chairman Hall follows:]

PREPARED STATEMENT OF CHAIRMAN RALPH M. HALL

I want to welcome everyone here today for this hearing on the President's Fiscal Year 2012 budget request for the Department of Energy.

This is the third time that Secretary Chu has appeared before this Committee, and I want to thank him for his willingness to be here and meet with our Members on Department of Energy programs and priorities.

This is also the third DOE budget that the President has sent Congress, so its general priorities-and my concerns with them-should come as no surprise.

What is notable, however, is the degree to which the President has "doubled-down" on his energy and climate agenda in light of the continued struggling economy, trillion-dollar deficits, rising gas prices, and fuel supply concerns driven by Middle East turmoil.

The centerpiece of this agenda is the President's proposed requirement that the U.S. produce 80 percent of its electricity from "clean" sources by 2035. While I want to better understand how the Administration intends to reach this goal, and while I strongly support an "all-of-the-above" approach to energy security, I'm concerned that this plan entails spending we can't afford and taxes and regulations that would raise the cost of energy and harm our economy.

The merits of this proposal seem weakened further by the fact that, even if such a transition to "clean" electricity were successful, its benefits in terms of the effect it could have on climate change appears negligible.

My concerns regarding misplaced energy policy priorities extend to the R&D budget as well. The fossil fuels that drive our economy and meet over 80 percent of our energy needs continue to be penalized in favor of "cleaner" alternatives.

For example, the Natural Gas and Unconventional Fossil Energy Technologies programs are zeroed out while energy efficiency and renewable energy R&D programs would receive a $1 billion, or 44 percent, increase above current levels. And these increases come on the heels of over $16 billion in Stimulus funding and a near-doubling of the EERE base budget since FY 2006. I'm also concerned that much of this "clean energy" spending is focused on late-stage technology development and commercialization more appropriately performed by the private sector.

The changes called for in this budget are not just trends-they represent dramatic shifts that warrant our close review and consideration in the coming weeks and months.

While I have many concerns, I look forward to working with the Secretary, Ranking Member Johnson, and members of the Committee to develop a thorough and constructive response to these proposals.

I now recognize Ranking Member Johnson for five minutes for an opening statement.

Chairman HALL. I now recognize the Ranking Member, Mrs. Johnson, for as long as she takes for an opening statement.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and welcome back to the Committee, Dr. Chu.

We are here today to discuss the President's fiscal year 2012 budget request for the Department of Energy, even though as the fiscal year 2011 budget still dominates the attention of the Congress. For both budget years and likely for years to come, the issue remains the same: While we must be fiscally responsible, we also must keep America competitive and create a better future for the American people.

I agree with Chairman Hall. We are in a dangerous position as it relates to our national deficit. As any responsible American family would do, we have to reconcile how much money the government spends and what it brings in. But we are also in danger of jeopardizing our standard of living and our future if we allow good programs to fall victim to indiscriminate cuts. It is time to set priorities and make choices that do not leave our workforce ill-prepared and hamper the country's ability to innovate and grow.

If a family's budget is squeezed, they don't solve the problem by pulling the kids out of school. We cannot roll back the clock on our economy. Our economic woes weren't caused by too much science. At a time like this, we need to make the critical investments to bolster our research infrastructure and our future workforce, advancing our technological capabilities now while sowing the seeds for the industries of the future. And let me be clear: I stand with the President and a number of respected conservative columnists, numerous policy experts, and I believe the American people when I say that these are investments and not just spending.

With research in science education, there is a guaranteed return. If the Continuing Resolution passed by the House two weeks ago were enacted, the Department of Energy's basic science and energy R&D portfolios as well as the extensive network of national laboratories and world-class facilities would be devastated. At the same time, these cuts would have negligible real impact on our national deficit. If this C.R. is enacted, it is known that within months STEM education, teacher training, workforce development and activities of DOE will likely cease. Many thousands of research scientists, graduate students, technical and administrative staff, contractors and other support staff across the country will be laid off or furloughed. The impact on indirect jobs is expected to even be greater. Research projects will be delayed or terminated. Unique world-class scientific facilities used by industry and academia will have operating times decrease, will be temporarily shuttered or even completely closed. Ongoing construction and upgrades at the labs and national user facilities will not move forward, costing more in scheduling delays and broken contracts, and restricting or eliminating access for academic and industrial researchers.

This is especially worrisome to me because as we know, the last hired are often the first fired. Many of the graduate students and early career researchers that our future depends on will likely be the first to lose their jobs. This strikes at the heart of a generation rife with a passion for innovating—young people who are willing to work long nights in labs across the country to find solutions to our Nation's economic, national security, energy, and environmental problems.

All of this could happen as countries like China, India, Germany, Japan and many others seize on our weakness in this economic downturn to invest billions of dollars to build up their own clean energy technology sectors to compete with or attract U.S. companies. For example, in 2009 alone, China's government investment attracted $35 billion in private capital for clean energy technologies. The United States came in a distant second, attracting a little more than half that much.

In the President's recent State of the Union address, he spoke at length about the need to reinvigorate the American capacity for innovation, and he highlighted the economic opportunities that lie in clean energy technologies. The fiscal year 2012 request for DOE proposes increases in a number of critical programs while making some tough but prudent decreases in others. This is a direct illustration of the President's commitment to a clean energy future and takes us into the opposite direction from where the C.R. would leave us.

This committee has heard from a number of organizations, industry associations, national labs and academia on the negative impact of the proposed C.R. cuts and the important roles these programs play in our economy.

Mr. Secretary, as you testify today, I hope to learn from you how the proposed cuts to DOE will impact our country's innovation pipeline and the young people preparing for careers in these exciting new fields, and how the President's vision will leave us better prepared to lead the global economy in this century. I look forward to working with you and members on both sides of the aisle on these important issues.

Thank you, Mr. Chairman. I yield back.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Thank you Chairman Hall, and welcome back to the Committee, Secretary Chu. We are here today to discuss the President's fiscal year 2012 budget request for the Department of Energy, even as the fiscal year ***2011*** budget still dominates the attention of Congress. For both budget years, and likely for years to come, the issue remains the same: while we must be fiscally responsible, we also must keep America competitive and create a better future the American people.

I agree with Chairman Hall—we are in a dangerous position as it relates to our national deficit. As any responsible American family would do, we have to reconcile how much money the government spends with what it brings in. But we are also in danger of jeopardizing our standard of living and our future if we allow good programs to fall victim to indiscriminate cuts. It is time to set priorities, and make hard choices that do not leave our workforce ill-prepared and hamper the country's ability to innovate and grow. If a family's budget is squeezed, they don't solve the problem by pulling the kids out of school.

We cannot roll back the clock on our economy. Our economic woes weren't caused by too much science. At a time like this we need to make the critical investments to bolster our research infrastructure and our future workforce, advancing our technological capabilities now, while sowing the seeds for the industries of the future. And let me clear; I stand with the President, a number of respected conservative columnists, numerous policy experts, and, I believe, the American people when I say that these are *"Investments"*, and not just "spending"! With research and science education, there is a guaranteed return.

If the Continuing Resolution (CR) passed by the House two weeks ago were enacted, the Department of Energy's basic science and energy RD&D portfolios, as well as its extensive network of National Laboratories and world-class facilities, would be devastated. At the same time these cuts would have a negligible real impact on our national deficit.

If this CR is enacted it is known that within months:

- Many thousands of research scientists, graduate students, technical and administrative staff, contractors, and other support staff across the country will be laid off of furloughed.
- The impact on indirect jobs is expected to be even greater.
- Research projects will be delayed or terminated.
- Unique, world-class scientific facilities used by industry and academia will have operating times decreased, will be temporarily shuttered, or even completely closed.
- STEM education, teacher training, and workforce development activities at DOE will likely cease.
- Ongoing construction and upgrades at the labs and national user facilities will not move forward, costing more in scheduling delays and broken con-

tracts and restricting or eliminating access for academic and industrial researchers.

This is especially worrisome to me because as we all know, the last hired are often the first fired. Many of the graduate students and early career researchers that our future depends upon will likely be the first to lose their jobs. This strikes at the heart of a generation ripe with a passion for innovating, young people who are willing to work long nights in labs across the country to find solutions to our nation's economic, national security, energy, and environmental problems.

All of this could happen as countries like China, India, Germany, Japan and many others seize on our weakness in this economic downturn to invest billions of dollars to build up their own clean energy technology sectors to compete with, or attract, U.S. companies. For example, in 2009 alone, China's government investment attracted almost $35 billion in private capital for clean energy technologies. The U.S. came in a distant second, attracting a little more than half as much.

In the President's recent State of the Union address he spoke at length about the need to reinvigorate the American capacity for innovation, and he highlighted the economic opportunity that lies in clean energy technologies. The FY 2012 request for DOE proposes increases for a number of critical programs, while making some tough but prudent decreases in others. This is a direct illustration of the President's commitment to a clean energy future, and takes us in the opposite direction from where the CR would leave us.

This Committee has heard from a number of organizations, industry associations, national labs and academia on the negative impact of the proposed CR cuts, and the important role these programs play in our economy. Mr. Secretary, as you testify today, I hope to learn from you how the proposed cuts to DOE will impact our country's innovation pipeline and the young people preparing for careers in these exciting new fields, and how the President's vision will leave us better prepared to lead the global economy in this century.

I look forward to working with you and Members from both sides of the aisle on these important issues.

Chairman HALL. Thank you, Ms. Johnson, for a good opening statement.

If there are Members who want to submit additional opening statements, your statements will be added to the record at this point.

I have the privilege of introducing the witness at this time. Dr. Chu serves as the 12th Secretary of Energy. Prior to his service as Secretary at DOE, Dr. Chu was the Director of DOE's Lawrence Berkeley National Lab and a professor of physics in molecular and cellular biology at the University of California. He was a co-winner of the 1997 Nobel Prize for Physics, and that is quite an honor.

As I know our witness knows, spoken testimony is limited to five minutes after which the members of the Committee will have five minutes each to ask questions. The chair is able to provide and the Committee is willing to provide some flexibility to you since you are our only witness today and for the important position that you hold and the gratitude we have to you for appearing before us. I recognize you at this time, sir.

STATEMENT OF DR. STEVEN CHU, SECRETARY, DEPARTMENT OF ENERGY

Secretary CHU. Thank you, Chairman Hall, and thank you, Ranking Member Johnson and members of this Committee. Thank you for the opportunity to discuss the President's fiscal 2012 budget request for the Department of Energy.

Before I begin my statement, I want to acknowledge the absence of Congresswoman Gabrielle Giffords, who has been a strong voice on energy issues, especially solar energy. It has been a privilege to work with her over the last two years and I look forward to working with her again as soon as she is ready to return to Washington.

President Obama has a plan for the United States to win the future by out-innovating, out-educating and out-building the rest of the world while at the same time addressing the deficit. This Committee understands the importance of science to our Nation's future. We must rev up the great American innovation machine to create jobs and secure our future prosperity.

Federal support for scientific research and our applied energy portfolio is critical for our competitiveness. The Department invests in early-stage research that the private sector often considers risky, and we leverage our resources to stimulate private sector investments in deployment.

To spur innovation, President Obama has called for increased investments in clean energy research, development and deployment. In addition, he has proposed a bold but achievable goal of generating 80 percent of America's electricity from clean sources by 2035. The clean energy standard would provide a clear long-term signal to industry to bring capital off the sidelines and into the clean energy sector. The most competitive clean energy sources will win in the marketplace. The government does not need to pick favorites.

The Department of Energy's fiscal year 2012 budget request of $29.5 billion supports the President's goals and strengthens the Nation's economy and security. Through energy efficiency programs, we will save money for consumers by saving energy. In addition, the budget supports the research, development and deployment of renewable energy, the modernization of the electric grid and the advancement of carbon capture and sequestration technologies, and it helps reduce our dependence on oil by developing the next generation of biofuels and accelerating electric vehicle research and development.

We are also requesting new credit subsidy to support loan guarantees for renewable and energy efficiency technologies. To jump-start the nuclear industry, we request up to $36 billion in loan guarantee authority while also investing in advanced nuclear technologies.

The President's budget also invests in basic and applied research and keeps us on the path to doubling the funding for key scientific agencies including the Office of Science. The budget invests $550 million in the Advanced Research Projects Agency-Energy, also known as ARPA–E. The Administration also seeks an additional $100 million for ARPA–E as part of the President's Wireless Innovation and Infrastructure Initiative. This investment will allow ARPA–E to continue promising early-stage research projects that aim to deliver game-changing clean energy technologies.

The Office of Science and ARPA–E play distinct and complementary rules in our research portfolio. The Office of Science supports basic research that furthers scientific understanding while ARPA–E supports high-risk, high-reward research projects to explore potentially transformative technologies.

Another piece of our research effort is the energy innovation hubs. Through the hubs, we are bringing together our Nation's top scientists and engineers to achieve similar game-changing energy goals but where a concentrated effort over a longer time horizon is needed to establish innovation leadership. The budget requests $146 million to support the three existing hubs and to establish three new hubs. And finally, the budget continues to support the Energy Frontier Research Centers which are mostly university-led teams working to solve scientific problems that are blocking clean energy development.

To reach our energy goals, we must take a portfolio approach to R&D pursuing several research strategies that have proven to be successful in the past. But I want to be clear: This is not a kitchen sink approach. This work is being coordinated and prioritized with a 360-degree view of how the pieces fit together. Taken together, these initiatives will help America lead in innovation.

In addition to strengthening our economy, the budget request also strengths our security by providing $11.8 billion for the Department's National Nuclear Security Administration.

The Department is also mindful of our responsibility to taxpayers. We are cutting back in multiple areas including eliminating unnecessary fossil fuel subsidies. We are streamlining operations. We are making some tough choices like freezing salaries and bonuses for hardworking national laboratory, site and facility management contractor employees.

The United States faces a choice today: Will we lead in innovation and out-compete the rest of the world or will we fall behind? To lead the world in clean energy, we must act now. We can't afford not to.

Thank you, and I will be pleased to answer any questions you may have.

[The prepared statement of Dr. Chu follows:]

PREPARED STATEMENT BY SECRETARY STEVEN CHU, U.S. DEPARTMENT OF ENERGY

Chairman Hall, Ranking Member Johnson, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the President's Fiscal Year 2012 budget request for the Department of Energy.

In his State of the Union address, President Obama laid out a plan for the United States to win the future by out-innovating, out-educating and out-building the rest of the world, while at the same time addressing the deficit. The President's budget request invests in much-needed programs while cutting back where we can afford to.

Many countries are moving aggressively to develop and deploy the clean energy technologies that the world will demand in the coming years and decades. As the President said, this is our generation's "Sputnik moment."

We must rev up the great American innovation machine to win the clean energy race and secure our future prosperity. To that end, President Obama has called for increased investments in clean energy research, development and deployment. In addition, he has proposed a bold but achievable goal of generating 80 percent of America's electricity from clean sources by 2035.

A Clean Energy Standard will provide a clear, long-term signal to industry to bring capital off the sidelines and into the clean energy sector. It will grow the domestic market for clean sources of energy - creating jobs, driving innovation and enhancing national security. And by drawing on a wide range of energy sources including renewables, nuclear, clean coal and natural gas, it will give utilities the flexibility they need to meet our clean energy goal while protecting consumers in every region of the country.

The Department of Energy's FY 12 budget request of $29.5 billion supports these goals and strengthens the nation's economy and security by investing in the following priorities:

- Supporting groundbreaking basic science, research and innovation to solve our energy challenges and ensure that the United States remains at the forefront of science and technology;
- Leading in the development and deployment of clean and efficient energy technologies to reduce our dependence on oil, accelerate the transition to a clean energy economy and promote economic competitiveness; and
- Strengthening national security by reducing nuclear dangers, maintaining a safe, secure and effective nuclear deterrent and cleaning up our Cold War nuclear legacy.

While we are investing in areas that are critical to our future, we are also rooting out programs that aren't needed and making hard choices to tighten our belt. Additionally, we are improving our management and operations so we function more efficiently and effectively.

Leading in the Global Clean Energy Economy

As the President said in his State of the Union address, investing in clean energy will strengthen our security, protect our planet, and create countless new jobs here at home. The Department's budget request invests $3.2 billion in energy efficiency and renewable energy programs.

Through programs to make homes and buildings more energy efficient, including a new "Better Buildings Initiative" to make commercial buildings 20 percent more efficient over the next decade, we will save money for families and businesses by saving energy. That is money that can be re-invested back into the economy. In addition, the budget supports the research, development and deployment of renewable sources of energy like wind, solar and geothermal. It supports the modernization of the electric grid and the advancement of carbon capture and sequestration technologies. And it helps reduce our dependence on oil by developing the next generation of biofuels and accelerating electric vehicle research and deployment to support the President's goal of putting one million electric vehicles on the road by 2015. This includes a $200 million competitive program to encourage communities to invest in electric vehicle infrastructure.

We're also focused on moving clean energy technologies from the lab to the marketplace. Over the past two years, the Department's loan programs have supported more than $26 billion in loans, loan guarantees, and conditional commitments to guarantee loans for 23 clean energy and enhanced automotive fuel efficiency projects across the country, which the companies estimate will create or save more than 58,000 jobs. Building on this success, we are requesting new credit subsidy that will support approximately $1 billion to $2 billion in loan guarantees for innovative renewable energy and energy efficiency technologies. These deployment efforts build on the substantial investment made in the clean energy sector by the Recovery Act, and are supplemented by tax incentives that have also played an important role in bringing clean energy projects to market, such as the 48C manufacturing tax credits and the 1603 cash grants in lieu of investment tax credits, which the 2012 budget also expands. We are also requesting $100 million in credit subsidy for a new "Better Buildings Pilot Loan Guarantee Initiative for Universities, Schools, and Hospitals," which will guarantee up to $2 billion in loans to support energy efficient retrofits.

Nuclear energy also has an important role to play in our energy portfolio. To jumpstart the domestic nuclear industry, the budget requests up to $36 billion in loan guarantee authority. It also invests in the research and development of advanced nuclear technologies, including small modular reactors.

Supporting Groundbreaking Science

To spur innovation, the President's budget request invests in basic and applied research and keeps us on the path to doubling funding for key science agencies, including the Department's Office of Science. As Norm Augustine, former Chairman of Lockheed Martin and former Under Secretary of the Army, has said, under-funding R&D in a time of austerity is like removing the engine of an aircraft to reduce its weight.

That is why the budget request increases support for the Department's comprehensive research strategy to accelerate energy breakthroughs.

Through $5.4 billion for the Office of Science, we're expanding our investment in basic energy sciences, advanced scientific computing and biological and environmental sciences - all key areas for our future economic competitiveness.

The budget invests $550 million in the Advanced Research Projects Agency-Energy, also known as ARPA-E. The Administration also seeks an additional $100 million for ARPA-E from the Wireless Innovation Fund to support wireless clean energy technologies. This investment will allow ARPA-E to continue the promising early-stage research projects that aim to deliver game-changing clean energy technologies. ARPA-E's projects are generating excitement both in the Department and in the private sector. For example, through a combined total of $24 million from ARPA-E, six companies have been able to advance their research efforts and show the potential viability of their cutting-edge technologies. This extremely valuable early support enabled those companies to achieve R&D milestones that, in turn, have attracted more than $100 million in private sector funds to the projects. This is precisely the innovation leverage that is needed to win the future.

Another key piece of our research effort is the Energy Innovation Hubs. Through the Hubs, we are bringing together our nation's top scientists and engineers to achieve similar game-changing energy goals, but where a concentrated effort over a longer time horizon is needed to establish innovation leadership. The Department has established three Energy Innovation Hubs in the areas of energy efficient buildings, modeling and simulation for nuclear reactors and fuels from sunlight. The budget requests $146 million to support the three existing Hubs and to establish three new Hubs in the areas of batteries and energy storage, smart grid technologies and systems, and critical materials. The Energy Innovation Hubs were modeled after the Department of Energy's BioEnergy Institutes, which have established an outstanding three-year track record.

Finally, the budget continues to support the Energy Frontier Research Centers, which are mostly university-led teams working to solve specific scientific problems that are blocking clean energy development.

The Energy Innovation Hubs, ARPA-E, and EFRCs represent three complementary approaches to advance groundbreaking discovery. When you think of the EFRCs, think about a collaborative team of scientists such as Watson and Crick unlocking the secrets of DNA. When you think of ARPA-E, think about visionary risk-takers launching new technologies and start-up companies out of their garages. When you think of the Hubs, think of large, mission-oriented research efforts such as the Manhattan Project, the development of radar at MIT's Radiation Laboratory during World War II and the research in America's great industrial laboratories in their heyday. We don't know where the big energy breakthroughs are going to come from. To reach our energy goals, we must take a portfolio approach to R&D: pursuing several research strategies that have proven to be successful in the past. But I want to be clear - this is not a “kitchen sink” approach. This work is being coordinated and prioritized, with a 360-degree view of how these pieces fit together. Taken together, these initiatives will help America lead in science and technology innovation.

Nuclear Safety and Security

In addition to strengthening our economy, the budget request also strengthens our security by providing $11.8 billion for the Department's National Nuclear Security Administration. The five-year FY 12 to FY 16 request of nearly $65 billion for NNSA reflects the President's nuclear security priorities, as well as his commitment to modernize the U.S. nuclear weapons enterprise and sustain a strong nuclear deterrent for the duration of the New START Treaty and beyond.

The request of $7.6 billion for Weapons Activities provides a strong basis for transitioning to a smaller yet still safe, secure and effective nuclear stockpile without additional nuclear testing. It also provides much-needed resources to strengthen science, technology and engineering capabilities and to modernize the physical infrastructure of our nuclear security enterprise. The President has identified the danger of terrorists getting their hands on nuclear weapons or the material to build them as the greatest threat to global security. To support the President's goal of securing all vulnerable nuclear material around the world in four years, the budget invests $2.5 billion in the NNSA Defense Nuclear Nonproliferation program. This is part of a five-year, $14.2 billion commitment for the program.

The budget also requests $1.2 billion to support the Navy's nuclear powered submarines and aircraft carriers. And it provides $6.1 billion to protect public health and safety by cleaning up the nation's Cold War nuclear legacy.

Fiscal Responsibility

Through our investments, we are laying the groundwork for the nation's future prosperity and security. At the same time, we are mindful of our responsibility to the taxpayer. We are cutting back in multiple areas, including eliminating unnecessary fossil fuel subsidies, reducing funding for the Fossil Energy program and reducing funding for the hydrogen technology program. We're streamlining operations to reduce administrative costs. And we're making some painful cuts, including ending operation of the Tevatron accelerator and freezing salary and bonuses for hard-working National Laboratory, site and facility management contractor employees.

Finally, we continue to make progress on a management excellence agenda to improve our operations.

The United States faces a choice today will we lead in innovation and out-compete the rest of the world or will we fall behind? To lead the world in clean energy, we must act now. We can't afford not to.

Thank you, and now I am pleased to answer any questions you may have.

HIGHLIGHTS OF THE FY 2012 BUDGET REQUEST

In his State of the Union address, President Obama said that America faces "our generation's Sputnik moment" and that we need to out-innovate, out-educate and out-build the rest of the world to capture the jobs of the 21st century. "In America, innovation doesn't just change our lives. It's how we make our living." Through innovation in promising areas like clean energy, the United States will win the future and create new industries and new jobs. To lead in the global clean energy economy, we must mobilize America's innovation machine in order to bring technologies from the laboratory to the marketplace. The Department of Energy (DOE) is on the front lines of this effort. To succeed, the Department will pursue game-changing breakthroughs, invest in innovative technologies, and demonstrate commercially viable solutions.

In addition to energy advances that spark economic growth, national security remains fundamental to the Department's mission. Through bipartisan ratification of the New START treaty with Russia, America and its global partners are leading by example in implementing the focused expansion of domestic and international activities to reduce the threat of nuclear weapons, nuclear proliferation, and unsecured or excess weapons-usable materials. The National Nuclear Security Administration (NNSA) supports the international effort to secure all vulnerable nuclear materials around the world within four years. The NNSA also fulfills the President's commitment to modernize the nation's nuclear stockpile until a world without nuclear weapons can be realized.

The Department's Fiscal Year (FY) 2012 budget request is $29.5 billion, an 11.8 percent or $3.1 billion increase from FY 2010 current appropriation levels. The FY 2012 request supports the President's goals to increase America's competitiveness by making strategic investments in our nation's clean energy infrastructure and to strengthen our national security by reducing the global threat of nuclear materials. The President has called for advancing research on clean energy technologies and manufacturing, doubling the share of electricity generated from clean energy supplies by 2035, and putting one million electric vehicles on the road by 2015. The Department's request prepares for a multi-year effort to address these interconnected objectives and prioritizes research and development of renewable energy technologies to expand sustainable energy options for the United States.

The FY 2012 budget builds on the intense planning, execution, and oversight of the $35.2 billion from the American Recovery and Reinvestment Act of 2009. By the end of FY 2010, the Department successfully obligated $32.7 billion of Recovery Act funds, including all funding that was set to expire. In developing the FY 2012 budget request, the Department has taken these investments into account and will oversee execution of these funds with value to the taxpayer in mind. Recovery Act investments are focused on energy conservation and renewable energy sources ($16.8 billion), environmental cleanup ($6 billion), loan guarantees for renewable energy and electric power transmission projects ($2.4 billion), grid modernization ($4.5 billion), carbon capture and sequestration ($3.4 billion), basic science research ($1.6 billion), and the Advanced Research Projects Agency - Energy ($0.4 billion). The Department's Recovery Act activities are strengthening the economy by providing much-needed investment, saving or creating tens of thousands of jobs, cutting carbon pollution, and reducing U.S. dependence on oil.

The President's FY 2012 Budget supports three strategic priorities:

- **Transformational Energy:** Accelerate the transformation to a clean energy economy and secure U.S. leadership in clean energy technologies.
- **Economic Prosperity:** Strengthen U.S. science and engineering efforts to serve as a cornerstone of our economic prosperity and lead through energy efficiency and secure forms of energy.
- **Nuclear Security:** Enhance nuclear security through defense, nonproliferation, naval reactors, and environmental cleanup efforts.

As the President has articulated, innovation is essential to America's economic competitiveness. To meet the challenge of 'our generation's Sputnik moment,' the Department supports a coordinated strategy for research and development across all of its programs. With every initiative the Department undertakes, sound science is at the core. In FY 2012, we will increasingly emphasize cross-cutting initiatives to link science throughout the Department, specifically with energy and national security programs in order to deliver results to the American taxpayer. In the Office of Science, the Department requests $5.4 billion, a 9.1 percent or $452 million increase over the FY 2010 current appropriation levels, to support an elevated focus on the advancement of the United States' leadership in fundamental research. Advanced Research Projects Agency - Energy (ARPA-E) is building on established gains since its initial funding in FY 2009 through the Recovery Act to perform transformational research and create game-changing breakthroughs for eventual market adoption. The FY 2012 budget request includes $550 million for ARPA-E to sustain investment in new energy technologies.

Energy Innovation Hubs play a key role in solving specific energy challenges by convening and focusing top scientific and engineering talent to focus on those problems. The Hubs bring together multidisciplinary team of researchers in an effort to speed research and shorten the path from scientific discovery to technological development and commercial deployment of highly promising energy-related technologies. The Department is proposing to double its commitment to this research approach by requesting three new Hubs to focus on batteries and energy storage, critical materials, and Smart Grid technologies and systems. The Department will continue funding the three Energy Innovation Hubs introduced in FY 2010 to focus on developing fuels that can be produced directly from sunlight, improving energy efficient building systems design, and using modeling and simulation tools to create a virtual model of an operating advanced nuclear reactor. Complementing the Hubs, the Department plans in FY 2012 to continue coordination with the Office of Science's Energy Frontier Research Centers, which exemplify the pursuits of broad-based science challenges for energy applications.

Energy Security: Promoting America's Energy Security through Reliable, Clean and Affordable Energy

In his State of the Union address, the President outlined clearly to the American people his roadmap for transforming our nation's energy economy to meet the demands of future generations. "Instead of subsidizing yesterday's energy, let's invest in tomorrow's," he said. To meet the President's challenge, the Department must recruit the sharpest research minds and build on its aggressive discovery agenda across all programs to achieve breakthroughs on the most pressing energy challenges facing the United States.

In his address, President Obama laid out a goal for clean energy sources to account for 80 percent of America's electricity by 2035. In FY 2012, the Department requests funds to help achieve this Presidential objective and address many of the energy delivery challenges facing American families and energy providers.

- **Applied Research, Development and Deployment:** Meeting the President's goal of making America the first country to have one million electric vehicles on the road by 2015, the Department will research cost competitive methods to develop electric vehicles, increase the adaptability and capacity of the grid to enable vehicle charging, incentivize communities to invest in electric vehicles and infrastructure and send these vehicles to the nation's roadways. The Department will also launch competitive manufacturing research for breakthrough technologies in energy efficiency diagnostics and retrofits to help business owners around the country save money on energy costs.
- **Loan Guarantees:** The Loan Programs Office (LPO) is a vital tool for promoting innovation in the energy sector across a broad portfolio of clean and efficient energy technologies. In FY 2012, the Department is requesting credit subsidies to support approximately $1 to $2 billion in loan guarantees for renewable energy deployment and up to $36 billion in additional authority to loan guarantees for nuclear power projects. The Department will also continue to streamline and prioritize the issuance of loan guarantees to leverage private sector investment in clean energy and energy efficiency projects that will save and create jobs.
- **Better Buildings Initiative:** Last year, commercial buildings consumed roughly 20 percent of all energy in the U.S. economy. Improving energy efficiency in our buildings can create jobs, save money, reduce our dependence on oil, and make our air cleaner. The President's Better Buildings Initiative

will make commercial buildings 20 percent more energy efficient over the next decade through initiatives that include: re-designing the current tax deduction for commercial buildings and upgrades to a credit that is more generous and that will encourage building owners and real estate investment trusts (REITs) to retrofit their properties; improving financing opportunities for retrofits through programs including a new Better Buildings Pilot Loan Guarantee Initiative for Universities, Schools and Hospitals, for which the Department of Energy requests $100 million in credit subsidy to guarantee up to $2 billion in loans for energy efficiency retrofits for these facilities; creating a $100 million Race to Green competitive grant program for state and municipal governments to implement innovative approaches to building codes, performance standards, and regulations so that commercial building efficiency will become the norm in communities across the country; and calling on CEOs and university presidents to join the Department of Energy and other Federal partners in a Better Buildings Challenge to make their organizations leaders in saving energy. The Better Buildings Initiative builds on our investments through the Recovery Act and our continued commitment to passing "HOMESTAR" legislation to encourage American families to make energy saving upgrades in their homes.

- **Electricity Reliability and Energy Management:** Reliable, affordable, efficient, and secure electric power is vital to expanding economic recovery, protecting critical infrastructures, and enabling the transition to renewable energy sources. The FY 2012 request invests $238 million to bring the next generation of grid modernization technologies closer to deployment and commercialization, to assist states and regional partners in grid modernization efforts, and to facilitate recovery from energy supply disruptions when they occur. The request includes a new Smart Grid Technology and Systems Hub that will address the total electricity system, covering applied science, technology, economic, and policy issues that affect our ability to modernize the grid. The FY 2012 request also plans an expansion of the Home Energy Score program that provides homeowners with information on how their homes can be more energy efficient and guidance for saving on home energy costs. This is in addition to the President's support for passage of the Home Star rebate program in 2011.

Investing in energy efficiency, renewable energy generation, and grid modernization are fundamental steps necessary for creating a clean energy economy. We must also invest in the improvement of existing sources of energy that will provide a bridge between current and future technologies. These technologies are already a major segment of the energy mix and will play a critical role in providing a solid foundation that will make possible the creation of a new energy economy.

- **Leadership in Nuclear Energy:** Nuclear energy currently supplies approximately 20 percent of the Nation's electricity and 70 percent of the Nation's clean, non-carbon electricity. The request for the Office of Nuclear Energy includes $380 million for research and development, in addition to key investments in supportive infrastructure. In addition, the Department is engaging in cost-shared activities with industry that may help accelerate commercial deployment of small modular reactors. The request includes funding for cost-shared design certification and licensing activities for small modular reactors, the deployment of which holds promise for vastly increasing the generation of clean energy on a cost competitive basis. The Department will also promote nuclear power through the Loan Guarantee Program, which is requesting up to $36 billion in additional loan guarantee authority in FY 2012.
- **Advanced Fossil Energy:** Experience in Carbon Capture and Storage: The world will continue to rely on coal-fired electrical generation to meet energy demand. It is imperative that the United States develop the technology to ensure that base-load electricity generation is as clean and reliable as possible. The Office of Fossil Energy requests $452.9 million for research and development of advanced coal-fueled power systems and carbon capture and storage technologies. The Budget focuses resources within the fossil energy program on activities that can reduce carbon pollution and have potential benefits for both the existing fleet and new power plants specifically, post-combustion capture R&D and geologic carbon storage R&D.
- **Ending Tax Subsidies to Fossil Fuel Producers:** In accordance with the President's agreement at the G-20 Summit in Pittsburgh to phase out subsidies for fossil fuels so that we can transition to a 21st century energy economy, the Administration proposes to repeal a number of tax preferences avail-

able for fossil fuels. Tax subsidies proposed for repeal include, but are not limited to: the credit for oil and gas produced from marginal wells; the deduction for costs paid or incurred for any tertiary injectant used as part of a tertiary oil recovery method; the ability to claim the domestic manufacturing deduction against income derived from the production of oil and gas and coal; and expensing the exploration and development costs for coal.

Economic Security: Sharpening America's Competitive Edge through a Clean Energy Economy

To meet "our generation's Sputnik moment" and promote economic competitiveness, the U.S. must demonstrate leadership in clean energy technologies. "We'll invest in biomedical research, information technology and especially clean energy technology - an investment that will strengthen our security, protect our planet, and create countless new jobs for our people," said President Obama before Congress in the State of the Union address. President Obama outlined his comprehensive vision to lead our nation's clean energy economy and provide economic security to Americans. As the Administration seeks to reduce federal government spending, the Department recognizes its role and has tightened its expenditures in several areas such as oil and natural gas. The FY 2012 budget request acknowledges the Department's missions to achieve these imperative goals while setting forth a clean energy economy for entrepreneurs and manufacturers to reclaim their competitive edge in clean energy innovation.

The Department plans to promote economic security by building on the progress made through the over $32 billion in grants and contracts under the American Recovery and Reinvestment Act of 2009, which made historic investments in the nation's economy and has put the country on target to double renewable energy generation by 2012. The Recovery Act helped create tens of thousands of jobs and, combined with the FY 2012 request, will help the Department accelerate the transition of our nation to a clean energy economy.

The President's FY 2012 Budget supports the plan to rebuild our economy through clean energy research and development by:

- **Expanding ARPA-E to spur innovation**–The President's request proposes $550 million for the Advanced Research Projects Agency - Energy (ARPA-E) program, plus an additional $100 million for the program from the Wireless Innovation and Infrastructure Initiative for a total of $650 million. ARPA-E performs transformational and cutting edge energy research with real-world applications in areas ranging from grid technology and power electronics to batteries and energy storage. The budget also supports programs with significant promise to provide reliable, sustainable energy across the country, such as the SunShot initiative aimed at making solar energy cost competitive. With focused investment in manufacturing innovation and industrial technical efficiencies, the President's proposal will move private sector capital off the shelves and into the marketplace.
- **Targeting investments for future economic growth**–To secure a competitive advantage in high-tech industries and maintain international leadership in scientific computing, we will invest in core research activities for energy technologies, the development of general biological design principles and new synthetic molecular toolkits to improve understanding of natural systems, and core research activities to advance the frontiers of high performance computing. Underlying these investments in research is the education and training of thousands of scientists and engineers who contribute to the skilled scientific workforce needed for a 21st century innovation economy.
- **Doubling the number of Energy Innovation Hubs to solve key challenges**–Innovation breakthroughs occur when scientists collaborate on focused problems. The FY 2012 budget request proposes three new Energy Innovation Hubs that will bring top American scientists to work in teams on critical energy challenges in areas such as critical materials, batteries and energy storage, and Smart Grid technologies. These will join three existing Hubs that focus on fuel generation from sunlight, building efficiency, and nuclear reactor modeling and simulation.
- **Integrating Research & Development**–The Department has identified areas where coordinated work by discovery-oriented science and applied energy technology programs hold the greatest promise for progress in achieving our energy goals. The Energy Systems Simulation to increase the efficiency of the Internal Combustion Engine (ICE) will produce a set of modern, validated computer codes that could be used by design engineers to optimize the

next generation of cleaner, more efficient combustion engines. An initiative on extreme environments will close the gap between actual and ideal performance of materials in nuclear environments. And the Department's Exascale Computing initiative will allow the Department to take the lead in developing the next generation of scientific tools and to advance scientific discoveries in solving practical problems.

- **Pursuing the passage of HOMESTAR**–Enactment of this program will create jobs by providing strong short-term incentives for energy efficiency improvements in residential buildings. The HOMESTAR program has the potential to accelerate our economic recovery by boosting demand for energy efficiency products and installation services. The program will provide rebates of $1000 to $3000 per household to encourage immediate investment in energy-efficient appliances, building mechanical systems and insulation, and whole-home energy efficiency retrofits. This program will help middle-class families save hundreds of dollars a year in energy costs while improving the comfort and value of their most important investment - their homes. In addition, the program would help reduce our economy's dependence on fossil fuels and support the development of an energy efficiency services sector in our economy.
- **Extending access to tax credit and tax grant programs**–Two provisions of the American Recovery and Reinvestment Act have been extraordinarily successful in spurring the deployment of renewable energy projects and building advanced manufacturing capabilities: Section 48C Advanced Energy Manufacturing Tax Credit program and the Section 1603 Energy Cash Assistance program. The Administration is pursuing an additional $5 billion in support for the Section 48C program, which, by providing a 30% tax credit for energy manufacturing facilities, will continue to help build a robust high-technology, U.S. manufacturing capacity to supply clean energy projects with U.S. made parts and equipment. The Section 1603 tax grant program has created tens of thousands of jobs in industries such as wind and solar by providing up-front incentives to thousands of projects. The Administration is seeking a one-year extension of this program.
- **Promoting efficient energy use in our everyday lives**–Currently, weatherization of more than 300,000 homes of low income families has been achieved, providing energy cost savings and financial relief to households. The FY 2012 request of $320 million continues residential weatherization, while increasing the focus on new innovative approaches to residential home weatherization.

National Security: Securing Nuclear and Radiological Materials, Maintaining Nuclear Deterrence, and Advancing Responsible Legacy Cleanup

A pillar of President Obama's national security agenda for the United States is to eliminate the global threat posed by nuclear weapons and prevent weapons-usable nuclear material from falling into the hands of terrorists. As part of this agenda, the Administration and Congress worked tirelessly toward the December 2010 bipartisan ratification of the New Strategic Arms Reduction Treaty (New START) with Russia, which cuts the number of strategic nuclear weapons each country can deploy to 1,550. After signing this agreement in April 2010, President Obama said, "In many ways, nuclear weapons represent both the darkest days of the Cold War, and the most troubling threats of our time. Today, we've taken another step forward in leaving behind the legacy of the 20th century while building a more secure future for our children. We've turned words into action. We've made progress that is clear and concrete. And we've demonstrated the importance of American leadership—and American partnership—on behalf of our own security, and the world's".

The Department's National Nuclear Security Administration (NNSA), through work with global partners and efforts to secure vulnerable nuclear materials, achieved significant milestones during FY 2010 and FY 2011 to reduce the risk of proliferation and leverage science to maintain our nation's nuclear deterrence. Additionally, the Environmental Management program made progress advancing responsible nuclear cleanup from the Cold War. The Department's FY 2012 request seeks to build upon these successes and advance the President's nuclear security agenda.

Reduce the Risk of Proliferation

In 2009, President Obama committed the United States to an international effort to secure vulnerable nuclear material worldwide in four years. To solidify international support for this effort, and to address the threat of nuclear terrorism, the

President convened leaders from 47 countries at the Washington Nuclear Security Summit in April 2010. The Summit resulted in a Communiqué which stated, "Nuclear terrorism is one of the most challenging threats to international security, and strong nuclear security measures are the most effective means to prevent terrorists, criminals, or other unauthorized actors from acquiring nuclear materials."

The FY 2012 budget for the NNSA Defense Nuclear Nonproliferation program will help advance further work that is needed to meet the goals of President Obama and the Nuclear Security Summit, recognizing the urgency of the threat and making the full commitment to global cooperation on nonproliferation. The budget provides $2.5 billion in FY 2012, and $14.2 billion through FY 2016 to detect, secure, and dispose of dangerous nuclear and radiological material worldwide. This request is a decrease of five percent, or $138 million, from the FY 2011 request, which reflects completion of accelerated efforts to secure vulnerable nuclear materials within the President's stated timeframe. The decrease also reflects our decision to await agreement between the United States and Russia on detailed implementation milestones prior to requesting additional U.S. pledged funding to support Russian plutonium disposition. The FY 2012 budget request follows through on securing vulnerable materials and supports efforts to design new technologies in support of treaty monitoring and verification, which will contribute to implementation of New START. The budget also broadens cooperative nonproliferation initiatives with foreign governments and international organizations in support of the President's objective of a world without nuclear weapons. The budget continues the provision of security upgrades at selected sites, both within the United States and in foreign countries, to address outsider and insider threats, and accelerates the pace of research reactor conversions from use of highly-enriched uranium fuel to low-enriched uranium fuel.

Leverage Science to Maintain Nuclear Deterrence

The FY 2012 budget request advances the Department's commitment to the national security interests of the United States through stewardship of a safe, secure and effective nuclear weapons stockpile without the use of underground nuclear testing. The 2010 Nuclear Posture Review Report calls for the United States to reduce nuclear force levels. As the United States begins the reduction required by New START, the science, technology and engineering capabilities and intellectual capacity within the nuclear security enterprise become more critical to sustaining the U.S. nuclear deterrent. NNSA continues to emphasize these capabilities, including functioning as a national science, technology, and engineering resource to other agencies with national security responsibilities. Through the NNSA, the Department requests $7.6 billion for the Weapons Activities appropriation, an 8.9 percent, or $621 million, increase from the President's FY 2011 request. It also is an 18.9 percent, or $1.205 million increase from the FY 2010 enacted appropriation. This increase reflects an investment strategy that provides a strong basis for transitioning to a smaller yet still safe, secure and effective nuclear stockpile without additional nuclear testing, strengthening the science, technology and engineering base, modernizing the physical infrastructure, and streamlining the enterprise's physical and operational footprint. These investments will further enable the Nuclear Posture Review's comprehensive nuclear defense strategy, based on current and projected global threats that rely less on nuclear weapons, while strengthening the nation's nuclear deterrent through completing major stockpile system life extensions, stabilizing the science, technology and engineering base, and modernizing the infrastructure.

The Naval Reactors program ensures the safe and reliable operation of reactor plants in nuclear-powered submarines and aircraft carriers, constituting 45 percent of the U.S. Navy's combatants. The FY 2012 request for Naval Reactors of $1.2 billion, is an increase of $83.2 million or 7.8 percent over the FY 2011 request and $209 million or 18.1 percent above the FY 2010 enacted appropriation. Funding for this program is ramping up for reactor design and development efforts for the Ohio Class Replacement Submarine ($121 million), refueling of the Land-Based Prototype ($99.5 million), and recapitalization of the naval spent nuclear fuel infrastructure for the Spent Fuel Handling Recapitalization program ($53.8 million) at the Naval Reactors Facility located at the Idaho National Laboratory.

Advance Responsible Environmental Cleanup

The FY 2012 budget includes $6.13 billion for the Office of Environmental Management (EM), to protect public health and safety by cleaning up hazardous, radioactive legacy waste from the Manhattan Project and the Cold War. This funding will allow the program to continue to accelerate cleaning up and closing sites, focusing on activities with the greatest risk reduction. Acceleration of cleaning up sites where funding would have immediate impact was established as the overarching objective of the $6 billion in Recovery Act funding. EM will use the remaining $309 million of Recovery Act funding during FY 2012 as it completes footprint reduction and near-term completion cleanup activities.

As the Department continues to make progress in completing environmental cleanup, the FY 2012 budget request of $170 million for the Office of Legacy Management supports the Department's long-term stewardship responsibilities and payment of pensions and benefits for former contractor workers after site closure.

DEPARTMENT OF ENERGY FY 2012 PROGRAM OFFICE HIGHLIGHTS

Office of Science: Invest in the Building Blocks of American Innovation

The Department of Energy's Office of Science (SC) delivers scientific discoveries and major scientific tools to transform our understanding of energy and matter and advance the energy, economic, and national security of the United States. SC is the largest Federal sponsor of basic research in the physical sciences, supporting programs in areas such as physics, chemistry, biology, environmental sciences, applied mathematics, and computational sciences. In FY 2012, the Department requests $5.4 billion, an increase of 9.1 percent over the FY 2010 current appropriation, to invest in basic research. The FY 2012 request supports the President's *Strategy for American Innovation*, and is consistent with the goal of doubling funding at key basic research agencies, including the Office of Science. The FY 2012 Office of Science budget request supports the following objectives from the *Strategy*, including:

- Unleash a clean energy revolution
- Strengthen and broaden American leadership in fundamental research
- Develop an advanced information technology ecosystem
- Educate the next generation with 21st century skills and create a world-class workforce

In FY 2012, SC continues to support fundamental research for scientific discovery, but today our country needs to move strongly to solve our energy problems. Therefore, the central theme of this year's budget in SC is research in new technologies for a clean energy future that address competing demands on our environment. These efforts, coordinated with the DOE applied technology programs and with input from the scientific community and industry, will emphasize research underpinning advances in non-carbon emitting energy sources, carbon capture and sequestration, transportation and fuel switching, transmission and energy storage, efficiency, and critical materials for energy applications.

In the area of advancing non-carbon energy sources, the FY 2012 budget request will provide for new investments in the science of interfaces and degradation relevant to solar photovoltaics, basic actinide chemistry research related to advanced nuclear fuel cycles, and research in materials under extreme environments relevant to extreme nuclear technology environments, and genomics-based research on biological design principles and synthetic biology tools to underpin bio-based energy solutions. Carbon capture and sequestration research will focus on novel molecular design for materials and multiscale dynamics of flow and plume migration, respectively. SC will initiate an energy systems simulation research effort focused on predictive modeling of combustion in an evolving fuel environment in support of the Department's efforts in transportation and alternative fuels. Also underpinning transportation and fuel switching, as well as energy storage, the FY 2012 request will support an Energy Innovation Hub for Batteries and Energy Storage. The Fuels from Sunlight Hub, established in FY 2010, as well as the Energy Frontier Research Centers and DOE Bioenergy Research Centers also continue. Research in enabling materials sciences will support needs of future electricity transmission systems and novel building materials to improve building efficiencies.

The FY 2012 budget request also provides for foundational science in condensed matter and materials physics, chemistry, biology, climate and environmental sciences, applied mathematics, computational and computer science, high energy physics, nuclear physics, plasma physics, and fusion energy sciences; and provides for research facilities and capabilities that keep U.S. researchers at the forefront of science. The FY 2012 request supports targeted increases in areas such as computational materials and chemistry by design, nanoelectronics, and advanced scientific applications and integrated application-hardware-software co-design for exascale, which position the U.S. to secure a competitive advantage in high-tech industries and maintain international leadership in scientific computing. Underlying these investments is the education and training of thousands of scientists and engineers who contribute to the skilled scientific workforce needed for the 21st century innovation economy.

The Office of Science supports investigators at about 300 academic institutions and from all of the DOE laboratories. Over 26,000 researchers from universities, national laboratories, industry, and international partners are expected to use the Office of Science scientific user facilities in FY 2012.

Advanced Research Projects Agency - Energy: Transformational Research and Development

The FY 2012 budget request includes $550 million for the Advanced Research Projects Agency - Energy (ARPA-E), plus an additional $100 million for the program from the Wireless Innovation and Infrastructure Initiative for a total of $650 million. ARPA-E was launched in FY 2009 to sponsor specific high-risk and high-payoff transformational research and development projects that overcome the long-term technological barriers in the development of energy technologies to meet the Nation's energy challenges, but that industry will not support at such an early stage. An essential component of ARPA-E's culture is an overarching focus on accelerating science to market. Beyond simply funding transformational research creating revolutionary technologies, ARPA-E is dedicated to the market adoption of those new technologies that will fuel the economy, create new jobs, reduce energy imports, improve energy efficiency, reduce energy-related emissions, and ensure that the U.S. maintains a technological lead in developing and deploying advanced energy technologies.

Office of Energy Efficiency and Renewable Energy: Investing in Breakthrough Technology and a Clean Energy Future

The Office of Energy Efficiency and Renewable Energy (EERE) supports research, development, demonstration, and deployment activities on technologies and practices essential for meeting national security goals by reducing dependence on oil, meeting environmental goals by minimizing the emissions associated with energy production and use, and stimulating economic growth and job creation by minimizing the cost of energy services. The EERE portfolio emphasizes work areas where the potential impact is largest, where Federal funds are most critical. It balances investments in high-risk research with partnerships with private firms that speed the translation of innovations into practical business opportunities. The diverse set of technologies supported helps ensure that the U.S. has many options for meeting its energy goals. Program management is designed to identify the best groups in the country to address these challenges and supports work in universities, companies, national laboratories, and consortia.

The FY 2012 budget request of $3.2 billion, the increase of 44.4% over the FY 2010 current appropriation, is aimed at accelerating innovation and change in the Nation's energy economy. The request includes programs associated with meeting the President's goals of investing in the next generation of clean energy technologies, vehicles and fuels, and energy efficiency measures that reduce energy use in Federal agencies and the industrial and building sectors.

Clean, Renewable Energy Generation

The FY 2012 budget request continues to work to transform the Nation's energy infrastructure by investing over $1,164.9 million in a variety of renewable programs including solar ($457.0 million), wind ($126.9 million), water ($38.5 million), hydrogen ($100.5 million), biomass ($340.5 million), and geothermal ($101.5 million). Research, development, and deployment of these technologies will reduce the production of greenhouse gas emissions and revitalize an economy built on the next generation of domestic production. The request includes the solar SunShot program which will invest in transformative research focusing on achieving radical cost reductions in photovoltaic modules, balance of systems, and power electronics.

Energy Efficiency

The Department implements a number of efforts to increase energy efficiency in homes, transportation, and industry. The FY 2012 budget requests $1,805.3 million to accelerate deployment of clean, cost-effective, and rapidly deployable energy efficiency measures in order to reduce energy consumption in residential and commercial buildings, and the industrial and Federal sectors. The Department will invest $470.7 million in the Building Technologies program and $33.0 million for the Federal Energy Management Program. Federal assistance for state-level programs such as State Energy Program ($63.8 million), Tribal ($10.0 million) and Weatherization Assistance Program ($320.0 million) will continue to help citizens implement energy efficiency measures, lower energy costs and greenhouse gas emissions, and build a technical workforce. ($319.8 million) for Industry will provide a balanced portfolio of advanced R&D and pursuit of near-term low cost opportunities with the objectives of increasing U.S. competitiveness, enhancing clean energy manufacturing, and improving energy productivity. There will be a focus on next generation manufacturing processes and materials, activities for clean energy manufacturing, and refocused efforts for Industrial Technical Assistance to achieve greater results with less funding through more effective leveraging of funding for deployment partnerships. A new Energy Innovation Hub on critical materials will be competed through the Industrial Technologies program. The FY 2012 request also includes $588 million to accelerate research, development and deployment of advanced vehicle technologies, working in concert with biomass RD&D to reduce the use of petroleum and greenhouse gas emissions.

Better Buildings Initiative for Commercial Energy Savings–The President's Better Buildings Initiative is focused on achieving a 20 percent improvement in commercial buildings' energy use by 2020. The initiative will include many new components to achieve this goal. The following are supported in the Department's FY 2012 request: launch of the Race to Green competitive grant program for states and municipal governments to encourage higher standards for commercial energy efficiency, which is funded within the Buildings Technologies Program; a new pilot loan guarantee program to support energy efficiency retrofits for buildings that serve as community assets; and increased R&D funding for building technologies. The Department intends to work with the business and academic communities to make their organizations leaders in saving energy.

Office of Electricity Delivery and Energy Reliability: Enabling a Clean Energy Economy

The Office of Electricity Delivery and Energy Reliability (OE) is responsible for leading national efforts to modernize the electric grid, enhance the security of energy infrastructure, and facilitate recovery from disruptions to the energy supply. The Department's FY 2012 budget request for OE of $238 million, a 38% increase over the FY 2010 appropriation, represents a clear and determined effort to accelerate the transformation of one of the Nation's key enablers of a clean energy economy - the electricity delivery system.

The U.S. electricity delivery system was built on technology that was developed early in the 20th century and designed for the demands and challenges of that era. Today, this aging and often congested system is facing many new and complex challenges that require considerable improvements in the physical and technological components of the system. In order to alleviate the stress on the system from increasing demand for electricity and to enable greater use and integration of renewable and distributed resources, all while maintaining the reliability, security, and affordability of electric power, research and development breakthroughs and new energy management approaches are critical in the areas of transmission and distribution, energy storage, and cyber security.

OE's FY 2012 budget request provides $193 million for research and development in these critical areas to bring the next generation of grid technologies closer to deployment and commercialization. The increased investment reflects the President's vision and OE's role in competing in a worldwide technological race. As such, with $20 million in FY 2012, OE will establish a new Energy Innovation Hub, or in the words of President Obama, one of "the Apollo projects of our time." The Smart Grid Technology and Systems Hub will bring together a diverse, multi-disciplinary group to develop an integrated approach to enhancing smart grid technologies and systems. OE will also expand its advanced modeling capabilities to include other system layers in order to provide a more in-depth system understanding. The energy storage program will expand to aggressively support the deployment of grid-scale energy storage technologies with new demonstrations, and the cyber security program will continue to focus on the development and integration of secure control systems.

The budget request continues to support Permitting, Siting, and Analysis (PSA) with $8 million to develop and improve policies, state laws, and programs that facilitate the development of electric infrastructure needed to bring new clean energy projects to market, and to provide technical assistance to states and regions. It also supports Infrastructure Security and Energy Restoration (ISER) with $6.2 million to enhance the reliability and resiliency of critical energy infrastructure and to facilitate recovery from energy supply disruptions.

Office of Environmental Management: Meeting Commitments and Making Progress

The mission of the Office of Environmental Management (EM) is to complete the safe cleanup of the environmental legacy brought about from over six decades of nuclear weapons development, production, and Government-sponsored nuclear energy research. This cleanup effort is the largest in the world, originally involving two million acres at 110 sites in 35 states, dealing with some of the most dangerous materials known to man. EM continues to pursue its cleanup objectives within the overall framework of achieving the greatest comparative risk reduction benefit and overlaying regulatory compliance commitments and best business practices to maximize cleanup progress. To support this approach, EM has prioritized its cleanup activities:

- Activities to maintain a safe and secure posture in the EM complex
- Radioactive tank waste stabilization, treatment, and disposal
- Spent nuclear fuel storage, receipt, and disposition
- Special nuclear material consolidation, processing, and disposition
- High priority groundwater remediation
- Transuranic and mixed/low-level waste disposition
- Soil and groundwater remediation
- Excess facilities deactivation and decommissioning

The FY 2012 budget request for $6.13 billion will fund activities to maintain a safe and secure posture in the EM complex and make progress against program goals and compliance commitments by reducing the greatest risks to the environment and public health, using science and technology to reduce lifecycle costs, and reducing EM's geographic footprint by 90 percent by 2015. EM continues to move forward with the development of the capability for dispositioning tank waste, nuclear materials, and spent (used) nuclear fuel. The budget request includes the construction and operation of three unique and complex tank waste processing plants to treat approximately 88 million gallons of radioactive tank waste for ultimate disposal. It will also fund the solid waste disposal infrastructure needed to support disposal of transuranic and low-level wastes generated by high-risk activities and the footprint reduction activities.

EM carries out its cleanup activities with the interests of stakeholders in mind. Most importantly, EM will continue to fulfill its responsibilities by conducting cleanup within a "Safety First" culture that integrates environment, safety, and health requirements and controls into all work activities to ensure protection to the workers, public, and the environment, and adheres to sound project and contract management principles. EM is also strengthening its project and planning analyses to better assess existing priorities and identify opportunities to accelerate cleanup work. Working collaboratively with the sites, EM continues to seek aggressive but achievable strategies for accelerating cleanup of discrete sites or segments of work. In addition, functional and cross-site activities such as elimination of specific groundwater contaminants, waste or material processing campaigns, or achievement of interim or final end-states are being evaluated.

After the EM program completes cleanup and closure of sites that no longer have an ongoing DOE mission, post closure stewardship activities are transferred to the Office of Legacy Management (LM). LM also receives sites remediated by the U.S. Army Corps of Engineers (Formerly Utilized Sites Remedial Action Program) and private licensees (Uranium Mill Tailings Radiation Control Act, Title II sites). Post closure stewardship includes long-term surveillance and maintenance activities such as groundwater monitoring, disposal cell maintenance, records management, and management of natural resources at sites where active remediation has been completed. At some sites the program includes management and administration of pension and post-retirement benefits for contractor retirees.

Loan Programs Office: Helping Finance Clean Energy Deployment

Innovative Technology Loan Guarantee Program -To encourage the early commercial deployment of new or significantly improved technologies in energy projects, the Department requests up to $36 billion in loan guarantee authority for nuclear power facilities and $200 million in appropriated credit subsidy to support an estimated $1 to $2 billion in loans for renewable energy system and efficient end-use energy technology projects under section 1703 of the Energy Policy Act of 2005. The additional loan guarantee authority for nuclear power projects will promote deployment of new plants and support an increasing role for private sector financing. The additional credit subsidy will allow for investment in the innovative renewable and efficiency technologies that are critical to meeting the Administration's goals for affordable, clean energy, technical leadership, and global competitiveness.

The FY 2012 budget also requests $38 million to evaluate applications received under the eight solicitations released to date and to ensure efficient and effective management of the Loan Guarantee program. This request is expected to be offset by collections from borrowers authorized under Title XVII of the Energy Policy Act of 2005 (P.L. 109-8).

Advanced Technology Vehicle Manufacturing Program -The Department requests $6 million to support ongoing loan monitoring activities associated with the program mission of making loans to automobile and automobile part manufacturers for the cost of re-equipping, expanding, or establishing manufacturing facilities in the United States to produce advanced technology vehicles or qualified components, and for associated engineering integration costs.

Better Buildings Pilot Loan Guarantee Initiative for Universities, Schools, and Hospitals -To spur investment in energy efficiency retrofits for buildings which serve as assets to our communities, the Department requests $100 million for loan guarantee subsidy costs to support up to $2 billion in loan authority for universities, schools, and hospitals. This pilot program is one component of the President's Better Buildings Initiative and would fund cost-effective technologies and measures to assist universities, schools, and hospitals save on energy usage and associated energy costs. The Department also requests $5 million for administrative expenses to carry out the program. The request is subject to the enactment of legislation authorizing this program.

Office of Nuclear Energy: Investing in Energy Innovation and Technical Leadership

The Department is requesting $852.5 million for the Office of Nuclear Energy (NE) in FY 2012 - a decrease of 0.6 percent from the FY 2010 current appropriation. NE's funding supports the advancement of nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration as appropriate. Currently, nuclear energy supplies approximately 20 percent of the Nation's electricity and over 70 percent of clean, non-carbon producing electricity. Over 100 nuclear power plants are offering reliable and affordable baseload electricity in the United States, and they are doing so without air pollution and greenhouse gas emissions. NE is working to develop innovative and transformative technologies to improve the competitiveness, safety and proliferation resistance of nuclear energy to support its continued use.

The FY 2012 budget supports a balanced set of research, development, and deployment (RD&D) activities. This program is built around exploring, through its R&D technology and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals; development of sustainable nuclear fuel cycles; and minimization of risks of nuclear proliferation and terrorism.

NE is requesting $125 million for Reactor Concepts Research, Development and Demonstration. This program seeks to develop new and advanced reactor designs and technologies. NE is also requesting $67 million for the Light Weight Reactor SMR Licensing Technical Support program, which will support cost-shared design certification and licensing activities for two light water reactor-based designs. Small modular reactors are a technology that the Department believes has the promise to help meet energy security goals. Work will continue on R&D for the Next Generation Nuclear Plant to support demonstration of gas-cooled reactor technology in the United States. The program also supports research on Generation IV and other advanced designs and efforts to extend the life of existing light water reactors.

The FY 2012 request includes $155 million for Fuel Cycle Research and Development to perform long-term, results-oriented science-based R&D to improve fuel cycle and waste management technologies to enable a safe, secure, and economic fuel cycle. The budget also requests $97.4 million to support the Nuclear Energy Enabling Technologies program, focused on the development of cross-cutting and transformative technologies relevant to multiple reactor and fuel cycle concepts. The Crosscutting Technology Development activity will focus on a variety of areas such as reactor materials, creative approaches to further reduce proliferation risks, and establishing advanced modeling and simulation capabilities to complement physical experimentation. The Transformative Nuclear Concepts R&D activity supports, via an open, competitive solicitation process, investigator-initiated projects that relate to any aspect of nuclear energy generation ensuring that good ideas have sufficient outlet for exploration. Modeling and Simulation Energy Innovation Hub, supported within this program, will apply existing modeling and simulation capabilities to create a “virtual” reactor user environment to simulate an operating reactor and is a prime example of the type of crosscutting, transformative activity that will enhance many research areas within NE. NE will also continue its commitments to investing in university research, international cooperation, and the Nation’s nuclear research infrastructure - important foundations to support continued technical advancement.

Office of Fossil Energy: Sustaining American Energy Options through U.S. Ingenuity The FY 2012 budget request of $521 million for the Office of Fossil Energy (FE) will help ensure that the United States can continue to rely on clean, affordable energy from traditional domestic fuel resources. The United States has 25 percent of the world’s coal reserves, and fossil fuels currently supply over 80 percent of the Nation’s energy.

The Department is committed to developing technologies and providing technology-based options having public benefits including enhanced economic, environmental and energy security impacts. In FER&D, the emphasis, in keeping with Presidential priorities, is in supporting long-term, high risk initiatives targeted at carbon capture and storage as well as advanced energy systems and on cross-cutting research.

In addition, $122 million of FE’s $521 million request will be to provide for national energy security through the continued operations of the Strategic Petroleum Reserve. The budget proposes to sell $500 million of SPR oil in order to provide operational flexibility in managing the Reserve.

The National Nuclear Security Administration: Leading Global Partners on Nonproliferation by Securing Vulnerable Nuclear Materials; Reaffirming Commitment to Stockpile Modernization The National Nuclear Security Administration (NNSA) continues significant efforts to meet Administration and Secretarial priorities, leveraging science to promote U.S. national security objectives. The FY 2012 President’s budget request for NNSA is $11.8 billion; an increase of 5.1 percent from the President’s FY 2011 Request. The five-year FY 2012-2016 President’s Request for the NNSA reflects the President’s global nuclear nonproliferation priorities and his commitment to modernize the U.S. nuclear weapons complex and sustain a strong nuclear deterrent, as described in the 2010 Nuclear Posture Review (NPR) Report, for the duration of the New START Treaty and beyond. The NNSA’s defense and homeland security-related objectives include:

- Ensure that the U.S. nuclear deterrent remains safe, secure and effective while implementing changes called for by the 2010 NPR and the New START Treaty
- Broaden and strengthen the NNSA’s science, technology and engineering mission to meet national security needs
- Transform the Nation’s Cold-War era weapons complex into a 21st century national security enterprise
- Work with global partners to secure all vulnerable nuclear materials around the world and implement the President’s nuclear security agenda expressed in the May 2010 National Security Strategy and the Nuclear Posture Review report
- Provide safe and effective nuclear propulsion for U.S. Navy warships

The FY 2012 budget request of $7.6 billion for the Weapons Activities appropriation provides funding for a wide range of programs. Requested activities include providing direct support for the nuclear weapon stockpile, including stockpile surveillance, annual assessments, life extension programs, and warhead dismantlement. Science, Technology and Engineering programs are focused on long-term vitality in science and engineering, and on performing R&D to sustain current and future stockpile stewardship capabilities without the need for underground nuclear testing. These programs also provide a base capability to support scientific research needed by other elements of the Department, the federal government national security community, and the academic and industrial communities. Infrastructure programs support facilities and operations at the government-owned, contractor-operated sites, including activities to maintain and steward the health of these sites for the long term and construct new facilities that will allow the United States to maintain a credible nuclear deterrent. The unique nuclear security expertise and resources maintained by NNSA are made available through the National Laboratories to other Departmental offices, agencies and to the Nation for security and counterterrorism activities.

The Weapons Activities request is an increase of 8.9 percent over the President’s FY 2011 Request. This level is sustained and increased in the later outyears. The multi-year increase is necessary to reflect the President’s commitment to maintain the safety, security and effectiveness of the nuclear deterrent without underground nuclear testing, consistent with the principles of the Report on the Plan for the Nuclear Weapons Stockpile, Nuclear Weapons Complex, and Delivery Platforms (known as the "1251 Report") and the Stockpile Management Program as stipulated in Sections 1251 and 3113(a)(2) of the National Defense Authorization Act of Fiscal Year 2010. Increases are provided for direct support of the nuclear weapon stockpile, for scientific, technical and engineering activities related to maintenance assessment and certification capabilities, and for recapitalization of key nuclear facilities. The President's Request provides funding necessary to protect the national resource of human capital at the national laboratories through a stockpile stewardship program that exercises and retains these capabilities.

The FY 2012 request for Defense Nuclear Nonproliferation (DNN) is $2.5 billion; a decrease of 5.1 percent from the President's FY 2011 Request. This decrease reflects completion of long-lead procurements for the Mixed Oxide Fuel Fabrication Facility (MOX) and Waste Solidification Building (WSB). It also reflects our decision to await an agreement between the U.S. and Russia on detailed implementation milestones prior to requesting additional U.S.-pledged funding to support Russian plutonium disposition. The Administration prioritizes U.S. leadership in global nonproliferation initiatives as directed through the National Security Strategy and has advanced this agenda through commitments from global partners during the 2010 Nuclear Security Summit. In addition to the programs funded solely by the NNSA, Defense Nuclear Nonproliferation programs support interagency and international efforts to protect national security by preventing the spread of nuclear weapons and nuclear materials to terrorist organizations and rogue states. These efforts are implemented in part through the International Atomic Energy Agency, the G8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction, and the Global Initiative to Combat Nuclear Terrorism.

DNN supports the President's goal to secure vulnerable nuclear materials around the world within four years. The Global Threat Reduction Initiative's emphasis in FY 2012 is to convert domestic and international nuclear reactors from weapons-usable highly enriched uranium fuel to low-enriched uranium fuel (LEU); while preserving our capability to produce the critically needed Molybdenum 99 isotope. The FY 2012 President's request for International Nuclear Materials Protection and Cooperation reflects selective new security upgrades to buildings and sites in accordance with the President's goal to secure vulnerable nuclear materials around the world within four years, as well as enhancements and sustainability support for previous work. The Fissile Materials Disposition program continues domestic construction of the MOX Fuel Fabrication Facility scheduled to come online in 2016; and design for the pit disassembly and conversion capability to provide it with plutonium oxide feedstock.

The President's request of $1.2 billion for Naval Reactors is an increase of 7.8 percent over the President's FY 2011 Request. The program supports the U.S. Navy's nuclear fleet, comprised of all of the Navy's 72 submarines and 11 aircraft carriers, which constitute 45 percent of the Navy's combatants. The U.S. relies on these ships every day, all over the world, to protect our national interests. The budget provides funding increases for the Ohio Class Replacement submarine to design and develop required submarine reactor plant technologies. R&D is underway now, and funding during this Future Years Nuclear Security Program is critical to support the long manufacturing spans for procurement of reactor plant components in 2017, and ship construction in 2019. Resources are also requested in FY 2012 to support design work for the recapitalization of the spent nuclear fuel handling infrastructure and refueling of the Land-based prototype.

The Office of the Administrator appropriation provides for federal program direction and support for NNSA's Headquarters and field installations. The FY 2012 request is $450.1 million; a 0.4 percent increase over the President's FY 2011 Request. This provides for well-managed, inclusive, responsive, and accountable organization through the strategic management of human capital, enhanced cost-effective utilization of information technology, and integration of budget and performance through transparent financial management practices. The increase reflects additional federal oversight for construction of the Pit Disassembly and Conversion project, the Uranium Processing Facility, and the Chemistry and Metallurgy Research Replacement Facility.

BIOGRAPHY OF SECRETARY STEVEN CHU, U.S. DEPARTMENT OF ENERGY

Dr. Steven Chu, distinguished scientist and co-winner of the Nobel Prize for Physics (1997), was appointed by President Obama as the 12th Secretary of Energy and sworn into office on January 21, 2009.

Dr. Chu has devoted his recent scientific career to the search for new solutions to our energy challenges and stopping global climate change—a mission he continues with even greater urgency as Secretary of Energy. He is charged with helping implement President Obama's ambitious agenda to invest in alternative and renewable energy, end our addiction to foreign oil, address the global climate crisis and create millions of new jobs.

Prior to his appointment, Dr. Chu was director of DOE's Lawrence Berkeley National Lab, and professor of Physics and Molecular and Cell Biology at the University of California. He successfully applied the techniques he developed in atomic physics to molecular biology, and since 2004, motivated by his deep interest in climate change, he has recently led the Lawrence Berkeley National Lab in pursuit of new alternative and renewable energies. Previously, he held positions at Stanford University and AT&T Bell Laboratories.

Professor Chu's research in atomic physics, quantum electronics, polymer and biophysics includes tests of fundamental theories in physics, the development of methods to laser cool and trap atoms, atom interferometry, and the manipulation and study of polymers and biological systems at the single molecule level. While at Stanford, he helped start Bio-X, a multi-disciplinary initiative that brings together the physical and biological sciences with engineering and medicine.

Secretary Chu is a member of the National Academy of Sciences, the American Philosophical Society, the Chinese Academy of Sciences, Academica Sinica, the Korean Academy of Sciences and Technology and numerous other civic and professional organizations. He received an A.B. degree in mathematics, a B.S. degree in physics from the University of Rochester, a Ph.D. in physics from the University of California, Berkeley as well as honorary degrees from 10 universities. Chu was born in Saint Louis, Missouri on February 28, 1948. He is married to Dr. Jean Chu, who holds a D.Phil. in Physics from Oxford and has served as chief of staff to two Stanford University presidents as well as Dean of Admissions. Secretary Chu has two grown sons, Geoffrey and Michael, by a previous marriage.

In announcing Dr. Chu's selection on December 15, 2008, President Obama said, "the future of our economy and national security is inextricably linked to one challenge: energy. Steven has blazed new trails as a scientist, teacher, and administrator, and has recently led the Berkeley National Laboratory in pursuit of new alternative and renewable energies. He is uniquely suited to be our next Secretary of Energy as we make this pursuit a guiding purpose of the Department of Energy, as well as a national mission."

Chairman HALL. I thank you, Dr. Chu, and I will recognize myself for five minutes.

My first question, and I may not have enough time to ask the second question, but the centerpiece proposal in President Obama's State of the Union address is his plan to require 80 percent of U.S. electricity to be derived from so-called clean energy sources, actually not defined anywhere that I can find so far. A study by economists at Suffolk University found that the cost of a clean energy standard similar to what the President is proposing would be almost $200 billion a year and over $4 trillion over a 20-year period, and that is, to be fair with you, a study of a similar plan, not this identical plan but of a similar plan. Other studies might estimate these figures to be higher or lower but as a matter of basic economics, doesn't the President's proposal amount to mandating Americans to pay significantly higher electricity costs? And in terms of restricting fossil fuel usage and raising electricity prices, wouldn't the clean energy sources have the same impact as the Administration's now-defunct cap-and-trade proposal?

Secretary CHU. Thank you, Mr. Chairman. I am not aware of that study, but first let me define what we mean by clean energy. Solar, wind, new hydro, nuclear, those are all clean energy, and we get full credit. If you looked at combined-cycle gas which generates about twice the electricity for the same amount of carbon emission, we would get half credit. If one develops coal with carbon capture and sequestration and suppose you capture 90 percent of the carbon emissions, that would count was 90 percent credit. So based on that rough definition, we are now currently generating 80 percent—40 percent of our energy as clean. Nuclear is—20 percent of the electricity is nuclear. Hydro is about 6–1/2, seven percent. The rest is a little bit of solar but the rest is predominantly wind and a little bit of geothermal.

So the President's goal of reaching 80 percent from 40 percent by 2035 anticipates, number one, that there will be a new investment in nuclear energy, and this is something we would like to grow as part of the portfolio. We project that more solar and photovoltaic and solar thermal will be in play and also more natural gas. When we develop clean coal technologies and we are going to be working very hard over the next decade to bring it down to affordable price, we think investments in clean coal technologies will kick in. So it is very important that that longer date, 2035, allows for the development of clean coal technologies, allows for the long planning process and construction process of nuclear.

In terms of how much it costs, we don't really know but I will tell you that I talk to the utility companies, in the coming decades, for example, Duke Energy tells me, Jim Rogers at Duke says in the next 50 years every power plant that they now own will have to be replaced and so the issue is when you have a long time horizon going from 2011 to 2035, you will have to replace a large fraction of these power plants and so it is in this replacement and building up as you—because, for example, many of our coal plants are over 40 or 50 years old. They are on their last legs. As you replace them with newer options, this is a very natural thing and so we want to give credit to get this going.

Now, my last comment about the clean energy standard is that there are estimates of $1 trillion to $2 trillion of capital sitting on the sidelines because of the uncertain conditions of what the United States should invest in, and what the clean energy standard does is, it tells companies, utility companies, it tells finance companies, this is the direction we are going, you will have a market. If you build an efficient, cost-effective way of generating electricity, you have a market, we can invest in you, and all that capital can come off the sidelines and immediately create jobs.

Chairman HALL. Do you agree that it will cost significantly more than that, or have you had that opinion?

Secretary CHU. I would want to get back to you on that and have, for example, the EIA and other analyses and give you a synopsis of what we think the costs will be. I would be happy to do that.

Chairman HALL. I appreciate it. I want to follow up. A core objective of the President's clean energy proposal is obviously addressing climate change. We look for that all the time. If the President's plan is significantly or successfully, I might say, implemented and we do indeed achieve the 80 percent, just double what you set out as 40 percent clean energy goal, how much effect could it have on climate change?

Secretary CHU. Well, the purpose of this is twofold. The major purpose of this clean energy standard is to unleash capital off the sidelines to allow for the private sector investment in clean energy technologies and also in energy efficiency which is turning very rapidly into a worldwide race for the development of these technologies. So the primary driver for what we are doing is, we are in a race now but the world is going to need newer, cleaner sources of energy, a more energy-efficient infrastructure. And this creates an incentive for business to invest their capital, private sector capital, in order to win in this race.

Now, having said that, if you look at what the President is proposing as a goal, 80 percent by 2035, this is more or less equivalent to a decrease in carbon dioxide that would put us on a path by midcentury 2050 of reducing the carbon dioxide by 50 percent. So it is in line with the original goal of doing that but the most important thing I want to return back to and emphasize is that we are now in a worldwide race. You see China, Japan, India, South Korea, European countries racing to develop these technologies because they know there is going to be a world market for them.

Chairman HALL. I thank you. I have gone over my time by a few seconds. I would like to ask how much effect do you really believe it will have, but I don't have the right to ask that because I am out of time. I thank you.

Now I recognize Mrs. Johnson for her questions.

Ms. JOHNSON. Thank you very much, Mr. Chairman.

Dr. Chu, as we attempt to cooperate in cutting some of the needed spending, one of the first things that we try to do is look at duplication. There is a lot of concern about duplicative programs both within DOE and other agencies. In terms of research, how would you define duplication?

Secretary CHU. Well, how would I define duplication? If certain research programs, for example, within Energy or within the Office of Science or ARPA–E are funding more or less the exact same type of research. You would not define it as there is solar research that could be short-term solar research tied to ARPA–E funds. You only have two years to get the private sector to pick it up. Very, very different than the solar research being funded in the Office of Science where you are mostly tackling basic fundamental science problems that can go to the next new thing. And so it sounds like the same, solar research, but it is a very different type of funding.

Ms. JOHNSON. There is also a growing sentiment that a number of the proposals for cuts will be applied to R&D. To me, that is one of the most important things that we can do in order to stay in the world race. What do you consider the most dangerous and growing sentiment for wasteful spending or investment in the future? How would you categorize some of the suggestions or recommendations or even what was passed in the C.R. two weeks ago?

Secretary CHU. Sure. All right. The President recognizes and certainly Congress recognizes that we are going to have to make such tough choices. The deficit is a huge problem and it has to be tackled. But having said that, if you just do across-the-board uniform cuts, this is not the way to run the country, this is not the way to manage the multiple varied programs. You have to make tough choices on what you want to invest in, and in this I am reminded of what Norm Augustine, a very legendary CEO and chair of Lockheed Martin had said, also well known in Congress on both sides of the aisle, very well respected, and he was CEO of Lockheed Martin and he said in his all experiences as an engineer, as a CEO and chair, if you have an overweight—in times of austerity, it is much like if you design an airplane and you realize the airplane is overweight and the way to trim the weight is to cut off an engine, that that would not do well.

And so you have to recognize what are going to be the engines that are driving the prosperity of our country, and the President has said very clearly that there are two engines. One engine is education, particularly science, engineering and mathematics education, STEM education, and the other engine is energy because it is no secret that many other countries around the world, most notably China, have recognized that this is a hugely growing technology opportunity and the country that leads in energy technologies in this multi-trillion-dollar market will be a very wealthy country, that you can wait and let other countries go first and we can be importing those technologies that we will need or we can be the front leader and be exporting those. And so in this race for prosperity that will create high-value manufacturing jobs in the United States. The President has said we have to pay attention to this. This is an internationally competitive race that we are in, and that was our Sputnik moment.

Ms. JOHNSON. Thank you. My time is up, but I need to ask one more question. Could you describe any type of impressive research that might be going on in China right now or India or any place?

Secretary CHU. If the chairman permits.

Chairman HALL. Without objection.

Secretary CHU. All right. Thank you. I would say if you look in terms of impressive research, they are superb in taking some existing technology and driving it better, so for that reason they now have the highest speed rail service in the world. They have captured that lead from France and from Japan. They now can produce the highest voltage and highest capacity transmission lines in the world, and they want to sell it to the United States. They are building about half of the nuclear reactors in the world today, over 25. They are the dominant force in silken photovoltaics or photovoltaics of any kind in the world. They have now taken over the leadership in exports of solar cells. They build the highest-efficiency coal plants with all the scrubbers and are now beginning to export them. Their coal plants are now 46 percent efficient of energy into electricity out. Our most advanced coal plants, I don't even think break 40 percent. And so I would say in every energy sector that I know, they are either getting into the lead or have become the leaders, and they see a worldwide export market.

Chairman HALL. The chair recognizes the gentleman from California, Mr. Rohrabacher, for five minutes.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman.

You just mentioned the President's characterization of the Sputnik moment, and let me just note, we are not in a Sputnik moment, we are in a deficit spending moment when you see that for the last two years straight and now for a third year in a row this Administration is proposing a level of deficit spending that is a shock to the system. We are talking a trillion and a half dollars a year more in debt for our children to pay, and I am suggesting to you that shock has had a major impact and has to make a major impact on our decision-making.

The answer that you just gave to the Ranking Member's question, of those technologies that you have just outlined for us that China is racing ahead in terms of putting them into place and into practice, how many of them are based on research that the Chinese did rather than research that was done in the United States or other countries that they have taken advantage of that research?

Secretary CHU. Okay. Thank you for the question. Well, let me go down the list. In nuclear technology, the United States made the first nuclear reactor as part of the Manhattan Project but leadership and very quickly in the 1970s and early 1980s constructed a fleet of roughly 100, a little over 100 civilian nuclear reactors but we don't own that leadership today and have not owned it for the last couple of decades.

Mr. ROHRABACHER. Right.

Secretary CHU. France——

Mr. ROHRABACHER. But in terms of China, how much of those which you just suggested, you had a list, are any of them based on the research that was done in China and not in the United States or what we are seeing here is vast amounts of research and—basically what we do is research and development here but we are unable to actually put it in place while our adversary in China takes it and runs with it. The problem isn't research and development and the creativity of the American people. Our problem is that we have got government in the way of people, entrepreneurs and investors and people who would like to use this technology here, and I would hope that perhaps the Department of Energy would put some of its effort into breaking through some of these barriers, one I would like to bring up with you today, and that is, we need to make sure if—the President's goal of having pollution-free energy sources is a wonderful goal. Whether we agree with you on global warming or not, that is irrelevant. The fact is, all of us should want less pollution in the air and cheaper energy.

So with that understanding, nuclear energy seems like something we could all come together on because at least the liberal left in this country has at least accepted the fact that nuclear energy needs to be something we look at. We have got new gas-cooled reactors that offer great promise, small gas-cooled reactors. How much money is being spent or how much emphasis, should I say, is being put on gas-cooled reactors as compared to light water reactors, which are the reactors of the past?

Secretary CHU. Yes, we are—we run a program called Next Generation Nuclear Reactors, and those are the gas reactors we are talking about. We are funding that very steadily, and I think in 2012 we hope to make a decision as to whether we go forward with building a prototype of those reactors. I share your enthusiasm in the sense that those gas-cooled reactors used as heat sources instead of electricity generation could be a very valuable source of energy that could supplement some of the energy we use, for example, natural gas in order to generate heat. And so we are very supportive of also small modular reactors, right size reactors where you can plop them down in places which don't have the infrastructure——

Mr. ROHRABACHER. With that said, we need help from the Department of Energy in breaking down the licensing process that is preventing the technology that we already—we have a capability of building those reactors right now. There are several companies that come to mind. We could go into production of this now except the licensing process will take a decade. We need to cut that down because we are spending a trillion dollars a year more than we are taking in, and this would certainly contribute to wealth creation in the United States. So I would hope that we can work together in breaking down that licensing process.

Secretary CHU. Thank you. Part of our 2012 budget request is for monies to help in the engineering to get licensing which is NRC, it is their job, but we will help those companies license the small modular reactors.

Mr. ROHRABACHER. Well, let us make sure the Chinese don't end up in production of these things that we are inventing right here when we could go into production ourselves and we just break down these governmental barriers.

Thank you very much, Mr. Chairman. Thank you, Dr. Chu.

Chairman HALL. Thank you, sir. The chair now recognizes the gentlelady from California, Ms. Lofgren.

Ms. LOFGREN. Thank you, Mr. Chairman, and thank you, Secretary Chu. You probably don't remember, but I do, the first time I met you, I happened to be on the Stanford campus the day you won the Nobel Prize, and the last time I think I saw you was also on the Stanford campus when we toured the Stanford linear accelerator.

I ask this not just to you as the Secretary, but as the really respected scientist that you are what the impacts of the C.R., if extended throughout the year, would have on the science that is in the Bay area. When we toured the Stanford linear accelerator, we saw what they were doing in terms of understanding at an atomic level, photosynthesis, for example. I think about the National Ignition Facility over in Lawrence Livermore, and it is a major scientific experiment; but, obviously if it is successful, it will have a profound impact on the energy picture for the world. Persis Drell has indicated that basically she thinks that the linear accelerator would have to simply shut down under the C.R. budget. What would the impact be on our science future if that were to occur, Dr. Chu?

Secretary CHU. Well, if you are speaking of the current 2011 C.R.——

Ms. LOFGREN. That is correct.

Secretary CHU. —and if you look at what the proposed 2011 budget is, what the C.R. was going to bring it back to, in fact, that we are halfway through the year, it would be something on the order of 40, maybe as high as a 50 percent cut in the Office of Science. At that level, and in some parts of the Office of Science it could be far more, so at that level I think Persis Drell's assessment is correct, that many of the user facilities like the new free electron laser, X-ray laser that SLAC has would have to be shut down for some time. A lot of graduate students and postdocs might have to be let go. This would—so as Ranking Member Johnson said, it would have a devastating impact on the number of jobs but the ripple effect would be much deeper because if the students, the engineering and science students see that federal funding of science can go up and down, bouncing like a yo-yo, they could easily assume—because most of the research dollars in science and engineering are ultimately at the Ph.D. level and master's level ultimately come from federal government. They would say this is not the career for me, or if they have a Ph.D. they perhaps look abroad to other countries.

So the ripple effect of unsteady up-and-down and certainly draconian cuts in science would be far more devastating than just the many thousands of jobs that would be lost or the accelerators that would be turned down and those accelerators, as you well know, are really engines of innovation. It is those accelerators which have changed the paradigm of how we do medical research and it is those accelerators that have changed the paradigm of how we do materials research. In those accelerators, we have made discoveries that have allowed us to improve upon the lithium ion battery in such a dramatic way. You know, the United States is—this is another one of these good stories where the United States of America invents the lithium ion battery, the dominant battery for plug-in hybrids and electric vehicles. Very quickly technology leadership went first to Japan, Sony, and now it is a big race between Japan and Korea. The year 2000, we made some basic science discoveries that all of a sudden say we can improve those batteries, we can improve the lifetime of the batteries, the energy density of the batteries, the safety of the batteries and it is less expensive to produce.

So we are in the process of recapturing that technology lead, and this is going to be a multi-billion-dollar business and so we need those science facilities. You don't want to ship them out.

Ms. LOFGREN. On the NIF, we have made a huge investment over the years in the NIF. What would this do if we project the C.R. across as the budget for the year, what would it do to that project?

Secretary CHU. Well, NIF comes from a different bucket of money.

Ms. LOFGREN. Okay.

Secretary CHU. This is funded not by the Office of Science. It is funded actually by the NNSA. And I think the NNSA in the C.R. is more protected because it is seen—its major mission is nuclear security, and to that extent, there would be less of an impact. I think the Office of Science impact would be pretty devastating.

Ms. LOFGREN. I will just say that I know my time is almost up, Mr. Chairman. My daughter was an undergraduate at Stanford and her roommate was a science major and my daughter was an English major, and when they graduated my daughter decided to go to law school where after three years she was able to earn more than a Member of Congress; whereas, her science roommate is still toiling away earning very little trying to get her Ph.D., and unless we incent science, the people who love science really won't stay. I also think the impact you said, the devastating impact this would have on the future of science, which is on the young scientists, is something that very much needs to be considered. I am glad that you raised it.

I yield back, Mr. Hall.

Chairman HALL. I hope your daughter is as fine and helpful to her profession as you have been to this Committee.

Now at this time I recognize Mr. Bartlett, one of the senior members of this Committee from Maryland, for 5 or 10 minutes, whatever he wants.

Mr. BARTLETT. Thank you very much.

Dr. Chu, thank you very much for your phone conversation yesterday. I have a couple of questions relative to the super-duty truck that I will submit for the record, sir, but I want to turn to your attention to some slides, the first of which I hope will show up on the screen.

[The information follows:]

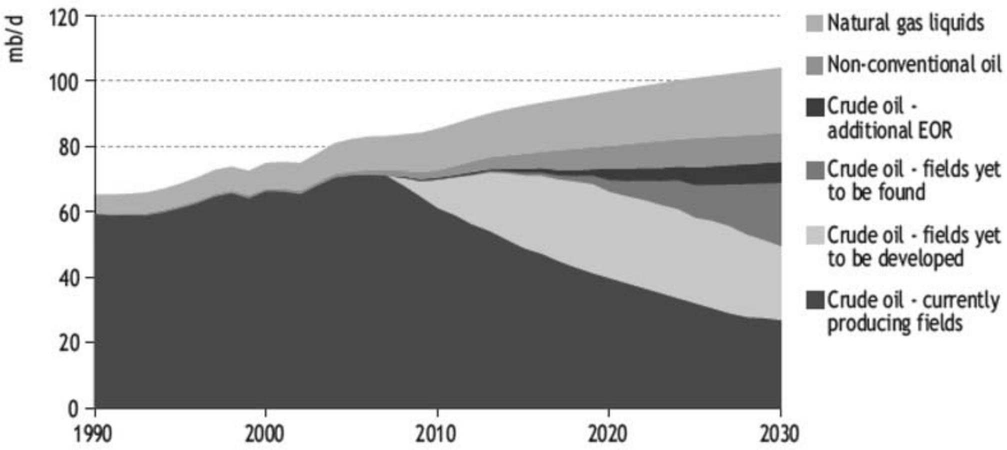
Rep. Roscoe Bartlett

Slides for QandA
Committee on Science, Space and Technology Hearing
The Department of Energy Fiscal Year 2012
Research and Development Budget
March 3, 2011

Mr. BARTLETT. Next slide.

[The information follows:]

Figure 11.1 • World oil production by source in the Reference Scenario

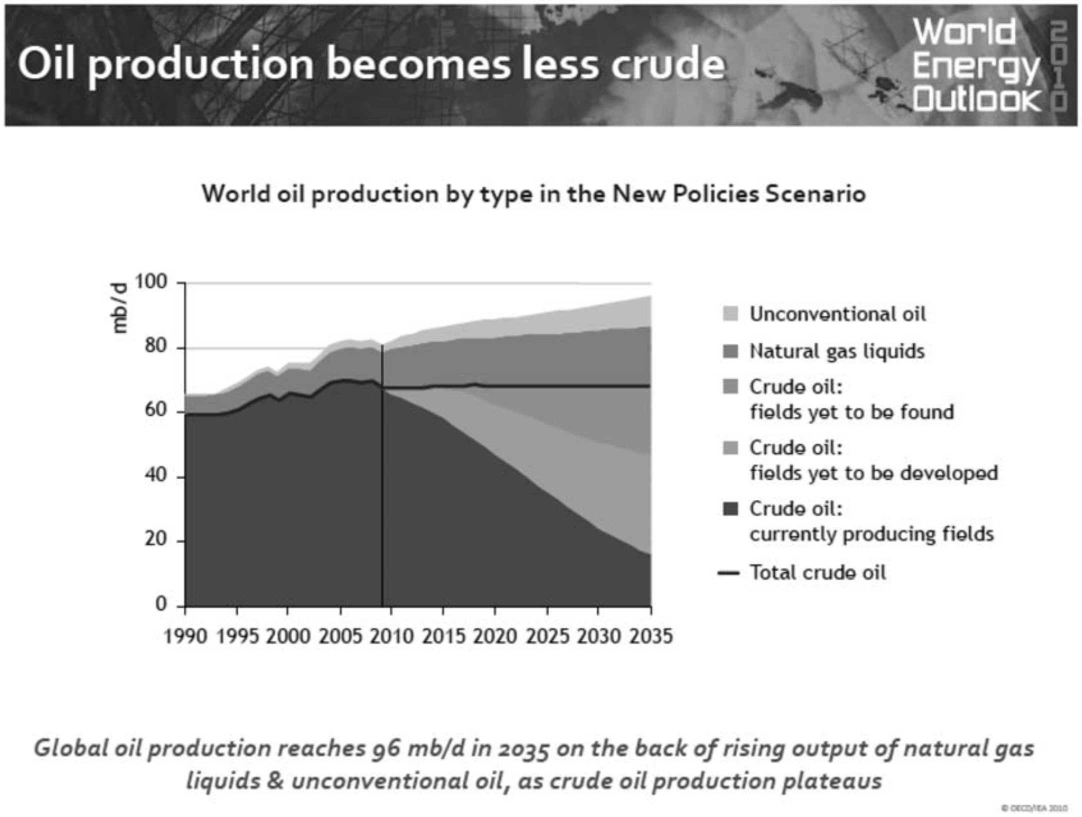


250 World Energy Outlook 2008 - **OIL AND GAS PRODUCTION PROSPECTS**

Mr. BARTLETT. Okay. I would like you to take a look at this slide, sir. This is a 2008 slide from the World Energy Outlook. Several interesting things about it. By 2030, they show the total amount of liquid fuels that we will have as about 106 million barrels a day. They show the crude oil that we will have from the fields that are now producing crude oil producing only about less than a fourth of that and they show huge contributions of oil from fields that we have now discovered but are too expensive to develop, and then a big red wedge there of crude oil from fields yet to be found. There is a dark red wedge there of enhanced oil recovery.

Now, if we can see the next chart.

[The information follows:]



Oil production becomes less crude

World oil production by type in the New Policies Scenario

Global oil production reaches 96 mb/d in 2035 on the back of rising output of natural gas liquids & unconventional oil, as crude oil production plateaus

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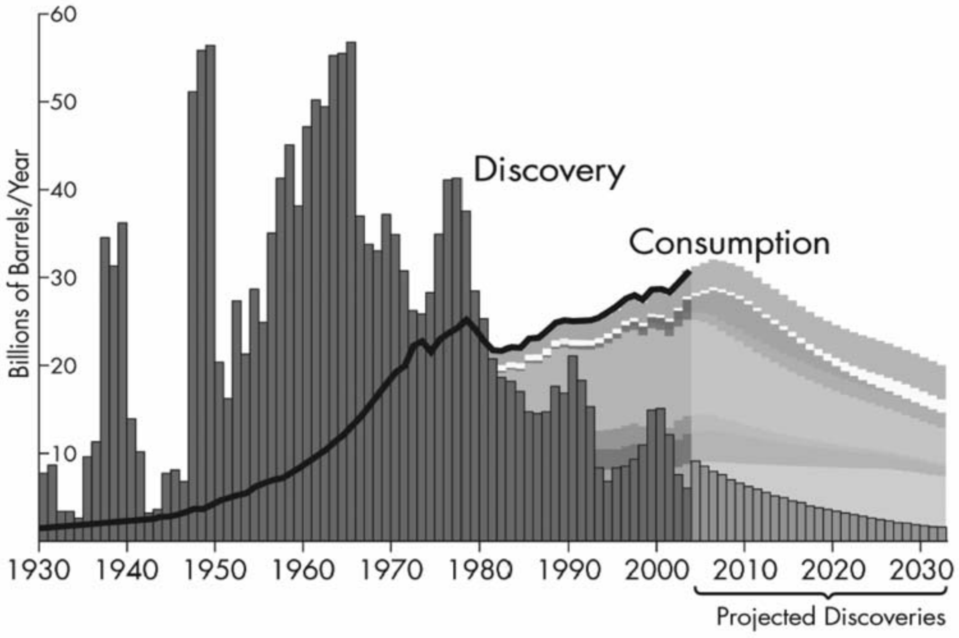
Mr. BARTLETT. And this is from exactly the same organization, and it is just two years later and some very remarkable differences occur. First of all, they no longer project that we are going to have 106 million barrels of oil a day by 2030, they now say we are going to have 96 million barrels a day by 2035, five years later, and they have only about a fourth of the conventional oil production coming from fields that we now pump. They have increased amounts of oil coming from fields yet to be developed and fields yet to be found. If you will look at the total amount of crude oil that they say will be available, it rises only very slightly between now and 2035.

[The information follows:]



Peak Oil – The Growing Gap

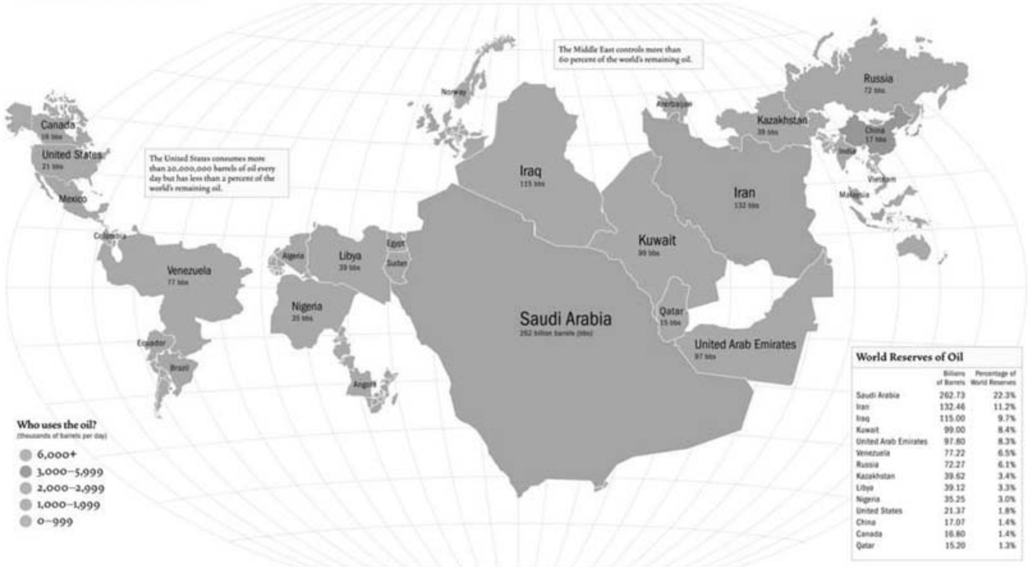
Mr. BARTLETT. If you look at the next slide, and if you have only one slide that you could look at to inform you about oil, it would be this slide. It is an old slide. You can see that it was a 2004 slide. And it shows the discoveries of oil through the past and you see them in the horizontal bars—I am sorry, in the vertical bars there, huge discoveries starting back in the late 1930s and the 1950s and 1960s, and notice from 1980 on we have always pumped more oil than we found, and they were projecting in this chart that we were going to reach peak oil production—that is that dark blue one in the previous two slides—we were going to reach that about when we did, about 2006 or 2007 or so, and that is exactly when it happened. That is now generally conceded to by just about every authority in the world.

Look over on the left over there at the ordinate, you see 10 billion barrels. That is a pretty big find of oil. We need to put that in perspective. It has been a long time since we found very many fields with more than 10 billion barrels of oil. Every 12 days, sir, as you know, the world uses a billion barrels of oil. Every 12 days, a billion barrels of oil. That is about 6th-grade arithmetic. Which means that if you have a 10-billion-barrel find, which is a big find, that will last the world 120 days. Big deal.

[The information follows:]

The World According to Oil

Who has the oil?



The United States consumes more than 20,000,000 barrels of oil every day but has less than 2 percent of the world's remaining oil.

The Middle East controls more than 60 percent of the world's remaining oil.

World Reserves of Oil

	Billions of Barrels	Percentage of World Reserves
Saudi Arabia	262.73	22.3%
Iran	132.46	11.2%
Iraq	115.00	9.7%
Kuwait	99.00	8.4%
United Arab Emirates	97.80	8.3%
Venezuela	77.22	6.5%
Russia	72.27	6.1%
Kazakhstan	39.62	3.4%
Libya	39.12	3.3%
Nigeria	35.25	3.0%
United States	21.37	1.8%
China	17.07	1.4%
Canada	16.80	1.4%
Qatar	15.20	1.3%

Each country's size is proportional to the amount of oil it contains (oil reserves). Source: BP Statistical Review Year End 2004 & Energy Information Administration

Mr. BARTLETT. And now if you look at the fourth slide, sir, and this shows the world according to oil, and Saudi Arabia needs to be diminished of it because Wikileaks a couple weeks ago indicated they have been fibbing about how much oil they have. I suspect much of the OPEC world has been fibbing about it. But, you know, there we are using a fourth of the world's oil, and we have only two percent of the world's oil. We are pumping eight percent of the world's oil, which means we are going to pump down very quickly.

Sir, isn't this pretty much the perfect storm at just the time that the world has reached its maximum oil production? And sir, if you believe that we are going to fill in those wedges with oil to be pumped from fields that we have now discovered and fields yet to be found, you probably believe you are going to solve your personal economic problems by winning the lottery. I think the odds are about the same. This is kind of the perfect storm, sir. We now have peak oil and we have the developing world leading it, trying to recover from a recession. We have the developing world, China and India, using hugely increased amounts of oil. We have the Wikileaks a couple weeks ago indicating that there is considerably less oil out there than we thought was out there, and now we have this unrest in the Middle East. Shouldn't there be a plan B, sir, in case the wildly optimistic projections of the World Energy Outlook and the EIA and the IEA are not true?

Secretary CHU. Okay. I think there should be a plan A.

Mr. BARTLETT. I don't even see a plan A. Plan A is business as usual, and that ain't going to work, sir.

Secretary CHU. So let me make a few comments. First, thank you for the slides. If you go back three slides at the world—that one. I will agree with you. We are near the peak of peak conventional oil. I think most oil companies will acknowledge that. What that means is, conventional oil is oil on land, easy-to-access oil, and what this projects is that there are—what it is doing is, it is logging in current reserves. Current reserves are bankable assets. I do feel that——

Mr. BARTLETT. That is the next chart, sir. It shows the reserves.

Secretary CHU. Right. But in this one, it essentially shows just a very slight increase if you include all forms of oil, oil yet to be discovered, oil produced in fields and unconventional oil meaning tar sands oil, very thick bituminous oil, things of that nature. And so certainly what this shows is that the oil supplies are plateauing at best and they are going to be plateauing and yet we see a dramatic rise in the world wealth of countries, especially in developing countries like China and India, where people—China is now the biggest car market in the world, 14, 15 million cars a year being sold in China, maybe 16 by now.

So what does that tell you? And as you go to harder-to-access oil, deep offshore oil, oil in the Arctic, more inconvenient oil, the lifting costs increase, so what that tells me is that the price of oil in the following decades because of the increased demand, because of our higher lifting costs of oil, the price of oil will go up. So our plan A is to recognize the price of oil will go. It will become a commodity in higher demand and so we should do whatever we can to decrease our dependency on oil, certainly our dependency on foreign oil but oil, period, because oil is, you know, as you noted, we consume 25 percent of the oil of the world. We only have two percent of the reserves.

So from that alone, you say so what do we do. Our plan A is to increase the fuel efficiency of cars and really push the pedal to the floor on that one. For the first time in 25 years, we have improved the EPA mileage standards but we have to do better in the following years.

Point two: We can electrify the vehicles. If you begin to electrify vehicles using batteries which I have a very strong belief that within four to five years we will be testing batteries to be put in cars that can enable us to drive 300 miles on a single charge in a midsized car and a battery that costs maybe a third of what it costs today. Okay. Under those conditions, you don't think about buying an electric car. Pure economics tell you, you just go buy an electric car. An electric car you plug in, you are using energy generated in the United States to charge your car, so you offset the oil dependency that way.

And finally, we are doing very promising research in biofuels. Already work done in the national labs is being licensed by companies in the private sector. They are doing testing demos of this, and we think, you know, the first thing is you use sugars and starches to get to ethanol but well beyond ethanol drop-in substitutes for diesel fuel and for gasoline for jet fuel. A company, Amers, is developing—is building a pilot plan now for a drop-in diesel fuel substitute. You feed it sugar, bacteria, make diesel fuel. They think they can sell it at $4 a gallon, diesel fuel, but that is just the beginning. Four dollars a gallon is still a little bit high, at $4 a gallon, a profit. You know, when you sell it at $3 a gallon, it is profit and now we are talking. And as you know, diesel fuel is about $3.50 a gallon now.

So the combination of biofuels made from woody material and agricultural waste, the electrification of vehicles. We also have gas supplies and so a number of companies are looking at delivery vans running off of natural gas. That could be a big player too. And all those things decrease our dependency on oil, and this is what I call our plan A.

Mr. BARTLETT. Sir, that is all true. Just one moment more, Mr. Chairman. That is all true, sir, but your government paid for four studies, two of them in 2005, two of them in 2007. They all say the same thing, that peaking oil was imminent with potentially devastating consequences. The Hirsch report, the big one, said if you didn't start planning for that 2 decades before it occurred there were going to be meaningful economic consequences.

Sir, we have run out of time. You don't really believe those two blue wedges are going to occur, do you?

Secretary CHU. Well, actually, I do believe some of it will occur, but be that as it may, I think you and I are in total agreement. We should be pushing as hard as we can to reduce our dependency on oil. We are—you know, $400, $300 billion a year is leaking out of our shores to bring in oil.

Mr. BARTLETT. Sir, I am way over time.

Thank you for your indulgence, Mr. Chairman. I yield back.

Chairman HALL. The senior citizen asked good questions and we got good answers. I don't believe you all are totally in agreement but your 20 minutes is up.

Secretary CHU. I apologize, Mr. Chairman.

Chairman HALL. It was good. You were giving good answers and it is in the record and I think if we can keep anybody awake that long they are going to enjoy reading everything we do.

Is Mr. Wu back? All right. Then I think we ask Mr. Miller, and I understand Mr. Miller has a request of the Committee.

Mr. MILLER. Yes, Mr. Chairman. I know that Representative Giffords has the affection and respect of every member of this Committee. She has been a very engaged, conscientious member. Her office has asked that I ask a question on her behalf, and I certainly want to accommodate her. And then if I could have perhaps not the full 20 minutes but a little more than five so I could ask the questions I intended to ask.

Chairman HALL. Without objection, you know you can do that. We want her questions asked, and she is living proof that prayers are answered, and thank you for representing her.

Mr. MILLER. And our prayers continue.

Secretary Chu, you have already mentioned that Ms. Giffords was a great advocate for solar power. President Obama at his State of the Union spoke of a "Sputnik moment," and 50 years ago President Kennedy called for an effort to go to the moon by the end of the decade. You called that the "moon shot" and you called for an effort that you called the "sun shot" to make solar electricity much more competitive in the next decade, specifically to bring down the cost by 75 percent, and to raise our once-dominant position in the market for solar voltaics. It was 43 percent in 1995. It is now six percent.

Ms. Giffords was a great advocate, as you have said. She, a couple years ago in the last Congress, pushed forward the *Solar Technology Roadmap Act*, which Congress, following her lead, this Committee and Congress adopted, and I am sure that she would like to know how the SunShot Initiative does compare to her *Solar Technology Roadmap Act* that she advocated for so effectively a year or two ago and how you plan to implement that SunShot Initiative.

Secretary CHU. Okay. Thank you for the question. I think in our SunShot Initiative, what we did is, we looked at what industry's own roadmaps were and we canvassed many companies both here and abroad, and where they think they could drive down the prices, and this is the full price, the cost of electricity. It is not the cost of the module itself but the electronics, the mounting, the land use, everything, insulation. And they found that within a decade one could reduce the cost, the full all-in cost by a factor of two, 50 percent reduction. And we thought that that was not quite good enough, and we began to talk with them and asked the question what could we do in the Department of Energy and what could they do in industry to bring that cost down more aggressively before the end of this decade, would it be possible to reduce the cost by 75 percent. Why 75 percent? That is the cost where solar power becomes competitive with any form of energy that we have today, the cheapest fossil fuel, and at that point the country that develops that has all of a sudden got a clear winner that you can export all over the world, the country and companies that develop that technology. That price point will be a very magical price point.

Remarkably, in this game plan that we started developing—and we didn't know which technologies would win. There is silken, there is crystal and silk and various thin-film technologies. There is even solar thermal. And all of these we looked and we said okay, what we can do is construct a program to give everyone a shot at this. They can all apply for grants. But where you see a clear driver down to this magical price. And the reaction in industry was actually amazing. I was talking with the CEO of Sun Power, a former professor of Stanford, Dick Swanson, who is now making the most efficient solar modules in the world, over 20 percent efficient, and he said, you know, you were great because after your guys started talking to us and we went and we started talking to our engineers, they began to realize yes, they can do better. This is amazing, that, you know, your spurring us and the back and forth between our scientists and their scientists, you know what, we can do better than we were planning to do. And so what this is now is a technological race among various approaches in the United States where the winner will reap many rewards. And so this is a very exciting thing.

When President Kennedy following President Eisenhower's speech about Sputnik and, you know—I might remind this committee, by the way, when Sputnik was first launched, his reaction to Sputnik is to say we have to invest in science and technology and education in science. He did not say let us put more money into rocket science and the military. It was a very long, far-reaching goal and said this is what it is about, the Russians have more scientists and engineers and the quality of their education is increasing and for the long-term benefit of the country this is what we have to invest in. It helps to have a five-star general to say this. And that started the National Science Foundation and all these other things.

So now returning back to the sun shot, we are very excited about this so going back to Kennedy, when Kennedy said before the end of the decade we will have a man on the moon, I am sure there are people in the audience and in America and worldwide who said that guy is nuts, how are we going to do this, but he wasn't. Before he made that announcement, he had a lot of detailed discussions with his scientific team, with the engineers and with the NASA folks to say no, this is bold, this is a long reach but it is achievable.

Mr. MILLER. Thank you. With my remaining 15 minutes, I wanted to ask about research generally.

Obviously energy research fared very badly in the Continuing Resolution passed by the House three weeks ago, and the argument by those who oppose the research was that it was really applied research, not basic research. I am not sure they are really any more favorably disposed towards basic research. But it is not like there is a bell that goes off when basic research crosses over into applied research, and the horizon of when some of this stuff may be commercially practical is pretty far out there, even if it is strictly speaking basic research.

What would happen to energy research generally if DOE was out of the mix of doing what would be called applied research, and is it really true that energy research by your department is crowding out—is it skewing—the marketplaceis it picking winners or losers, is it really crowding out research the private sector would otherwise be doing?

Secretary CHU. The short answer is no but let me follow up by giving you a few examples. If you look, for example, at what we are funding in the applied research area in things like better air conditioning or better manufacturing practices for photo cells, this is in our ARPA–E program. We made our first tranche of funds. We invested in, I think, something like 37 projects, 37 companies, and these companies already half a dozen receiving grants on the $3 million to $4 million for two years and then after that it is over. You have to go get money from another program, the private sector somewhere. Half a dozen companies have already done the research that they can then go back to the investment community and say look, it is working, and those half a dozen companies have received over $100 million of private sector funding because they proved using our research dollars to do first-stage proof of principle, the private investors said we think it is going to work, here is some more money.

This is exactly what we want to do in the private sector. Were we crowding out the money? No. In fact, if they couldn't prove to the private sector, the investment community, the VC people that this is actually viable by doing that first little experiment, they wouldn't have gotten the money. But as soon as they get the money—I mean, we well imagined that in many of these companies that first $100 million will actually be generating hundreds and hundreds of millions of dollars as it looks more and more likely that it will be a winner.

Mr. MILLER. I thank the Chair for his indulgence.

Thank you, Secretary Chu.

Chairman HALL. I thank you, and thank you, Mr. Secretary.

I might remind the Members that we are even and even now on time, and if we can kind of stick to our five minutes out of respect to the other Members who are waiting. I will recognize the chairman of I&O, Dr. Broun, for his five minutes.

Mr. BROUN. Thank you, Mr. Chairman.

Secretary Chu, thank you for being with us here today. This Committee requested documents regarding the Administration's decision to cancel the Yucca Mountain projects on May 7, 2009, February 3, 2010, July 20, 2010, and again on February 14, 2011. Until I became chair of the Investigation and Oversight Subcommittee, I received little more than press releases from your department and copies of letters from other Members of Congress in response to these requests. Understanding that I have requested these documents since May of 2009, when can I expect a full and a final production of these documents, and do you intend to withhold any of these documents?

Secretary CHU. No. My understanding is, we have now turned over thousands of pages of documents to you and your staff.

Mr. BROUN. Sir, we have not gotten the documentation and I would appreciate your doing so as quickly as possible.

Secretary CHU. I will look into it but we——

Mr. BROUN. If you intend to withhold documents, would you provide an index to identify each document withheld, to state the exemption claimed and explain how disclosure would damage the interests protected by the claimed exemption?

Changing courses a little bit, in September 2008, you stated, "Somehow we have to figure out how to boost the price of gasoline to the levels in Europe." Well, gas is projected to go to $5 or $6 a gallon just this summer. We have an unstable Middle East with potential of having a marked reduction of Middle East oil being available. This will increase the price of all goods and services and especially food and other necessary things. It is going to destroy jobs here in this economy and hurt our economy tremendously.

Sir, when is this Administration going to stop prohibiting the development of our own God-given natural energy resources here in the United States and start to pursue an all-of-the-above energy policy and develop those particularly here in the United States such as ANWR, OCS and those onshore?

Secretary CHU. Well, first, in my role as Secretary of Energy, everything we are doing is to develop alternative fuels to help drive down the price of oil because as we are developing those——

Mr. BROUN. Sir, that may be true, but we have got a lot of oil available and it is not just about oil, it is natural gas, it is coal, it is everything that we have, and this Administration has been prohibiting the development of our own resources. Congressman Bartlett showed us some slides that I have seen and you have seen and all of us on this Committee have seen, but this Administration is focusing on alternative sources of energy, and I applaud that. We all applaud trying to have more nuclear energy and that sort of thing but we have energy sources that are available here today, and this Administration is blocking the retrieval of those energy sources.

I just beg of you, sir, work to start allowing us to tap into all these energy resources including the oil and gas we have today, and this Administration has been blocking the production and development of those energy resources. It is critical for our economy, it is critical for jobs, it is critical for everything. So please, please, continue to look for alternative sources, I applaud that, but we need an all-of-the-above energy policy, not just looking to solar and wind and battery production and those types of things. We have oil. We have gas. We have coal. We have other sources. We have nuclear energy. It is very difficult to get licensing. We need to pursue an all-of-the-above energy policy, and I don't see this Administration pursuing that, and I hope and pray for the good of all the United States' citizens, for employees and employers that we do so.

My time is up. Thank you so much.

Chairman HALL. Thank you for staying within your five minutes.

The gentlelady from Ohio, Ms. Fudge.

Ms. FUDGE. Thank you very much, Mr. Chairman, and thank you, Dr. Chu.

Dr. Chu, I have one question for you. One of the issues that I am most concerned with is the effects of energy generation on public health which disproportionately affects low-income urban communities like my district in Cleveland, Ohio. Congress has spent time recently debating EPA regulations and the *Clean Air Act*. One way to keep our air healthy is by developing new and cleaner methods for energy generation. Could you please describe for me within my five minutes some of DOE's research and development activities that have contributed to cleaner technology with a focus on public health?

Secretary CHU. Sure. Thank you. If the chairman would permit, if I could spend maybe 30 seconds answering the last question that Mr. Broun asked me?

Chairman HALL. Well, he——

Secretary CHU. He is still here, so it is good. I think developing oil and gas resources in the United States is part of the Administration policy, and the President did announce opening access to more drilling in the Gulf with impeccable timing. He announced that two weeks before the Macondo well blowout. And we see that, and I agree with you. I think we do need an all-of-the-above. You can develop oil and gas in the United States but remember that is two percent of the known reserves in the world and we are 25 percent. So as part of an integrated policy, we feel that that is appropriate. And so——

Mr. BROUN. I meant ANWR, and further putting out——

Ms. FUDGE. I just want you to know this is not on my time, Mr. Chairman.

Chairman HALL. We are going to start your time all over again.

Secretary CHU. Okay. So—and—so as long as it is part of an integrated policy, we see it is part, and all-of-the-above is needed.

Mr. BROUN. Thank you.

Secretary CHU. So in response to your question, Congresswoman, I think if you look at the methods we are doing, first, the Department of Energy has done a lot of research in the capture of sulfur dioxide, nitrogen oxides, mercury particulate matter. We were very helpful in the Clean Air Act of 1992, I believe it was, in helping develop those technologies that actually made it possible to capture the pollutants that were creating the acid rain that was killing a substantial part of our forests and lakes and rivers, particularly in the Northeast, and that has been very successful. The costs are about one-quarter, one-fifth of what they initially were estimated to be and they are still plunging. So the initial costs were overestimates because we tend to underestimate how good technology becomes when given a task.

Going forward, if you look at the types of technologies we are now investing in research both the oxycombustion were you burn it in carbon dioxide atmosphere and capture that both in gasification, you are creating power plants that are essentially pollution-free. The amount of particulate matter, the mercury, SOx and NOx that are going to be released is going to be near zero. And so this will go a long way to helping with all the respiratory illnesses and deaths we now suffer in the United States from those pollutants and the mercury that has clearly invaded our rivers and lakes.

Ms. FUDGE. Okay. I would just ask that as you go forward, though, that you pay particular interest to what goes on in minority communities because I believe that you will find the incidence of the effects of these things that you just talked about are higher in communities that are minority communities. Thank you very much.

Mr. Chairman, I yield back.

Chairman HALL. I thank you for yielding back.

The chair now recognizes the gentleman from Tennessee, Mr. Fleischmann.

Mr. FLEISCHMANN. Thank you, Mr. Chairman.

Mr. Secretary, Chuck Fleischmann. I represent Tennessee three, which has the great national treasure of ORNL and Y12. Thank you for being here today.

Mr. Secretary, it is encouraging to see your support for nuclear power, specifically for small modular reactors or what we call SMRs, which will be an important source of energy for the increasing electricity demands of our country. Recently I met with Deputy Secretary Poneman. He visited with me and we talked about the importance of an American nuclear industry. In my district, the Tennessee Valley Authority is looking to add additional nuclear power to its system using SMR technology. The Oak Ridge National Laboratory and the Y12 weapons complex are big energy consumers and require safe, affordable and reliable power for major science and national security needs. It is impressive that your department is making progress on a cost-share program but there is also a regulatory hurdle which has been brought to my attention.

The Department of Energy apparently is prohibited by a federal directive from long-term contracts with utility companies on power purchase agreements. This is a serious roadblock. How will DOE handle the need for long-term power purchase agreements, sir?

Secretary CHU. All right. I will certainly look into that. There are numerous roadblocks like that. I think it has to do with utility companies and traditional power providers protecting their turf, and so we will look into it and see if we can come to some accommodation. I certainly know within the TVA, I have met with the head of the TVA, that they are very keen. They have a number of very old coal plants that are really at the end or past the end of their life, very inefficient plants, highly polluting plants, and they look at small modular reactors as a possible substitute solution to that. They are small enough that they can be dropped in substitutes for these coal plants because the electricity transmission distribution infrastructure is matched to the smaller reactors.

And so we are very keen on that. In fact, in Oak Ridge there is the Cinch River site, which could be an ideal first adopter of small modular reactor there that could power all of Oak Ridge, and as you know, we are investing—in the fiscal year 2012 budget we are asking for funds, and we hope Congress can give us these funds so that we can help a number of companies accelerate the licensing and processing, to help them with their engineering drawings that the NRC would demand, but I plan to look into that and get back to you on the regulatory hurdles of what would prevent us from generating power.

Mr. FLEISCHMANN. Thank you. I have one follow-up question in my time remaining. Recently I visited the Oak Ridge National Lab and I had the pleasure of a district tour and saw the Jaguar, which was I think until recently the world's fastest unclassified computer. It was a wonderful tour. Last November, though, the Chinese edged out the United States in supercomputing speed. China holds the record on two of the top five fastest computers of the world. That one measurement, Mr. Secretary, doesn't tell the full story since the United States maintains an impressive lead, I think, in supercomputing with half of the world's top 500 supercomputers located in the United States.

My question, Mr. Secretary, is, what is the Department's long-term strategy to ensure that we don't cede our Nation's premier leadership position in advanced computing?

Secretary CHU. Yes. We in our 2012 budget are requesting funds to start a new sustained project in going to the next level. The Jaguar computer is what we call a petaflop. A petaflop is 10 to the 12 floating point operations per second or more. That is a lot of floating point operations, 10 to the 12. No, this is 10 to the 15. Sorry. And so the next thousandfold development of a computer that is a thousand times faster than the Jaguar is something that we would like to develop in our 2012 budget. We have culled money from other parts of the Department including the National Security Agency as well as Office of Science to develop a roadmap and a plan to get us to this new exascale, so called exascale computer.

We believe that these high-performance computers are not only incredible—we need them for our nuclear security and for the science but we have also found recently in the last, certainly in the last half decade that these simulations are so good, you can actually design things like a new diesel internal combustion engine and you can simulate the very complex dynamics of what is happening in this diesel engine and all the chemical reactions that are occurring at this, you know, thousandth of a second and shorter time scales and so Cummins Diesel was able to use our supercomputers to design an engine to skip the prototype design and they went right to manufacturing, and saved the development of a new engine 15 percent of the cost.

We are using these supercomputers to design the next generation of nuclear reactors the same way because we are looking towards the next generation in carbon capture and sequestration but what we are finding is that the simulation ability of these computers is so good now, you begin to skip design stages where you make it, see if it works, twiddle around with it, make it, see if it works, twiddle around with it. You make it on a computer, see if it works on a computer and you can twiddle a lot better on a computer. And so this is a real economic opportunity and we do not want to lose that leadership.

Mr. FLEISCHMANN. Thank you, Mr. Secretary.

Thank you, Mr. Chairman.

Chairman HALL. I thank you.

I now know how you won the Nobel Prize. When they asked you a question, by golly, you answered it. And I am going to give a Nobel Prize for patience to Mr. Sarbanes but he left. If he comes back, we will recognize him first next time, okay? At this time I recognize Mr. McNerney, the gentleman from California.

Mr. MCNERNEY. Thank you, Mr. Chairman.

Thank you, Mr. Secretary, for appearing before us. Your discussion on the lithium batteries hit home personally because of my experience in industry. I spent 20 years developing wind energy technology, and because of poor government policy, I saw that technology go overseas, particularly to Germany at first and then to India and produce jobs in those countries, real jobs that should have been produced here in this country. So I am very concerned about that déjà vu happening again with our current Continuing Resolution.

Now, I have always thought that our universities are the premier—University of California, University of Texas, University of North Carolina and so on, Stanford and Harvard—for producing an environment of innovation and technology development and so on, and I would like to see what your opinion is in terms of how this sort of budgeting will affect those institutions vis-à-vis comparison to universities in other countries.

Secretary CHU. Yes. Thank you for that question, very much so thank you. The research universities in the United States are still the greatest research universities in the world, bar none. There is still something very, very good about the way we educate our graduate students. It may be deeply in our culture because in research it is very different than textbook learning. You don't know what the answer is. There is no authority to tell you this is right and that is wrong. And so you actually have to be probing and you are constantly questioning, being able to question authority, and for whatever reason, the American research universities are very good. So the most innovative, creative things, and the world recognizes this. But they are also working very hard to try to duplicate those atmospheres in other countries.

Now, specifically your question, if we start throttling back in funding for not only the Department of Energy but the NSF, the NIH and others but the Department of Energy, I think most people don't realize is the largest funder of the physical sciences in the United States. It has funded the work of more Nobel laureates than any other funding agency in the world, and it has trained scores of Nobel laureates. When I was a graduate student at Berkeley, a postdoc at Berkeley, I was also a member of Lawrence Berkeley National Lab. That lab alone helped start the careers of 30 people that went on to get Nobel Prizes, a national laboratory. And so the funding cuts that we see, I see the whole thing being put at risk where the real engine driver for all this innovation, which is the research universities and those national labs, are then put at risk. And so one can come back 10 or 20 years from today and say oops.

Now, China is working very, very hard to develop their universities. They have now begun to lure back Chinese who have gotten their Ph.D.s and postdocs and have been professors here or work in companies here to come back now in their 30s and 40s to assume leadership positions in academia and industry and so these are not the people who are 65 but these are the people in their—because they see great opportunity there, and there is great opportunity there. So we cannot take for granted all the people that came to get educated in the United States. If they see oh, no more research funding in the United States, they are going to have to look elsewhere.

Mr. MCNERNEY. I have time to ask at least one more question. Lawrence Livermore Laboratories is adjacent to my district and many of the employees that work there live in my district. I have been following the National Ignition Facility progress with great interest. Could you talk a little bit about the potential for fusion technology and our leadership in that area?

Secretary CHU. Sure. The NIF facility, it was initially funded for defense so that if you wanted to actually test what is happening at these very high energies and implosions, this is a way of doing it without nuclear testing. And so we can—and it is part of our stockpile stewardship program. Now, having said that, the fact is that these lasers, what they do is, there is a little pellet, really small, hundreds of microns, huge laser power then generates X-rays that compress this. The Office of Science has now gotten very interested in this because to be able to bring this fantastic amount of energy and power to actually create a microthermonuclear explosion. If—now, many things have to happen. That means that you are now creating fusion energy, and NIF within a very short time will go what they call where you get a huge output, much more power out than in, and you will get a thermonuclear implosion of these little itty bitty pellets. And so there is a group there at Livermore who thinks that it may be possible that this could lead to a source of fusion power.

Now, having said that, I think this is still very researchy. You have to develop a laser system that is economical, that can work 10 or 20 times a second instead of one or two times a day but it has to work very reliably at that rate because this is turning on our lights and keeping our lights on. And so it is in the future but we have that possibility and so again, in this vein of research, there is another approach to fusion energy.

Mr. MCNERNEY. Thank you, Mr. Chairman. I would like to dedicate the negative balance to the other side.

Chairman HALL. Thank you. You are pretty close and I respect you for it.

At this time I recognize Mrs. Biggert, the gentlelady from Illinois, for five minutes.

Mrs. BIGGERT. Thank you very much, Mr. Chairman.

Mr. Secretary, thank you for being here today. It is nice to see you again, and I apologize for not being here for your testimony as I have been in a markup and we haven't even gotten through the first amendment of the first bill.

But I just wanted to ask you a couple questions, and I think that you know my long history of support for the Office of Science and I have always maintained that scientific leadership in this country will create the jobs of the future and keep our country competitive, and I know you agree with that. But considering the budget decisions that we face, how would you strategically conserve spending with the department while preserving programs that are integral to our scientific enterprise and international leadership? And specifically basic energy sciences and computing come to mind. And China's latest supercomputer is a threat to our leadership computing capabilities and we are on the cusp of outpacing them unless U.S. research is not prioritized responsibly. So do you have any suggestions that might help us strategically prioritize our basic research programs within the budget constraints that we face?

Secretary CHU. Sure. First of all, you know, whatever Congress decides to give the Department of Energy, I hope I would be asked to be a partner in the funding decisions, but I will tip my hand and tell you what my leanings are. If we have a diminished budget, I would tend to push to make less investments on the deployment side, the very applied side, the parts where we are helping industry get it out in the field. We would just hope that we can structure policies that would induce private investments. I think the most precious part of our budget is the part that will be continuing to lay the seeds that give you the innovations five years and ten years and 15 years, and that is the Office of Science. And next to the Office of Science is ARPA–E but ARPA–E is not in competition with the Office of Science. ARPA–E is an applied research program, a much shorter term, and it should be seen as part of the applied area, okay. The Office of Science does investment in a different time scale.

Mrs. BIGGERT. I am glad to hear that you say that because I think that the risk science really is in the Office of Science.

Secretary CHU. Yes. You weren't here when I was bragging about an event that happened in Argonne National Laboratory. I didn't identify it as Argonne National Laboratory but the research in the Singatron facility there that led to the new lithium ion battery and the addition of manganese was research done at Argonne National Laboratory and it was done and was considered basic research but within a very short time it was licensed and its findings went into the Chevy Volt battery. And so that is a beautiful example of how science can actually deliver the goods, sometimes in much shorter time scale than one would ever expect.

Mrs. BIGGERT. Well, I just had the opportunity to drive a Chevy Volt this morning, so it is quite a car. I didn't drive it too fast or too far away. They wouldn't let me put it on the road for racing.

Secondly, I wanted to ask about the term "energy efficiency." It is something that many of us have embraced as an all-of-the-above energy approach, and I understand the department is trying to reduce its energy and emissions footprint as part of a department-wide initiative, an Executive Order across all sectors of the government. So under those guidelines, is there any concern for our large-scale user facilities and the amount of power that they would consume?

Secretary CHU. Yes, there is a great deal of concern for those because in many instances, they do consume a lot of power. Now, the good news is, for example, going to supercomputers, the Jaguar computer at Oak Ridge, for example, or the supercomputer at Argonne consume tremendous amounts of power but the Department of Energy is very focused on developing research so the next generation of supercomputers on a per-unit calculational basis should be consuming several hundred times less power per operation, and we think this is possible. In fact, it is not only possible, if you don't decrease the energy appetite a hundred fold, 300 fold, you can't actually get to the next level of computing which we think we will need. And so we think it is going to—so a large part of what we do now when we design new accelerators, new computers that consume a lot of power is, the power management and the energy consumption is a very integral part of what is going on.

Mrs. BIGGERT. And would that affect the advanced photon source too?

Secretary CHU. Yes, but remember, the other thing we would like to do is, we would like to get a few of these things. We would like to get a few small modular reactors going, so all of a sudden now you have clean power than can deliver as well because there are certain things—but even in accelerators, the last generation built accelerators, for example, the Large Hadron Collider at Cern, it is superconducting and it actually consumes less power than one of the little injectors. And so again, this attention to—we can't use our entire science budget to run the electricity is very much part of the culture now.

Mrs. BIGGERT. I thank you. My time is expired.

Chairman HALL. I thank the gentlelady.

I will now quickly recognize the gentleman from Michigan, Mr. Clarke.

Mr. CLARKE. Thank you, Chairman Hall, and I want to thank the gentlelady from Illinois for that great transition regarding the Chevy Volt. I represent the district that produces the Chevy Volt, and your department has helped promote that technology in vehicle electrification that is going to put Detroit back on the map. In fact, it is already on the map in terms of now developing the best electrified vehicles in the world.

Your department through its basic materials science for battery chemistries, your applied research for onboard power electronics and also the modeling for preparation of the electric charging infrastructure all happens within different offices within your department. I am thankful for your support. But others might say that this may not be an efficient way to allocate department resources. The Government Accountability Office, I know they have looked in areas of government where we can be more efficient, where we can reduce or eliminate waste and duplication. How has your department fared under this GAO review?

Secretary CHU. So far we have fared very well but there is no telling what will happen, you know, next week or next month. I think the GAO review was very kind to us, but to your point about duplication, let me tell you what we are doing.

You mentioned the battery program. The battery program is supported in three major areas. There is the more basics physics chemistry part of the batteries which is in the Office of Science in the energy efficiency renewable section, we have a very strong battery group, and now ARPA–E has a battery group. And so in the last half year and going forward forever on—and I was in a review for about an hour, a little over an hour looking at the detailed things they were planning and what they were supporting and what the prospects were, but all three groups were in the room, and going forward what we are doing is, we—if you think any sector, batteries, transmission distribution, biofuels, advanced biofuels, photovoltaics, what we are doing is, we are putting into teams that cut across the formal organizational lines. For example, in our SunShot, we hired a young engineer, youngish engineer, Ramesh. We got him to come to the Department of Energy, give up a little of his life to be in charge of SunShot. He just got elected to—you know, he is in his 40s. He just got elected to the National Academy of Engineering. He had a very good situation. Why would he ever want to come to the government? Because he could then cut across all these organizations and said we are going to have a unified plan to develop how are we going to help industry get there and be the winner, and what can we do in the Department of Energy, what can we do in the research to fill in the spaces where industry might not want to invest in but industry tells us this is the most important thing, okay, but it may be too forward-looking for them to invest in it, given the constraints of their shareholders or their founders.

So we are tackling this in a very different way because what I found when I became the Secretary is there would be a very good group in a certain area but they wouldn't even know what the groups in another area were doing. Biofuels were in the applied area I was looking at—they brought in a very good guy who was developing a program. They gave me his plan. You know, I take these and I put all sorts of comments and type all over it. But then what I did is, I took that plan and I gave it to the three directors of the biofuel centers that are supported by the Office of Science because they hadn't—this is the plan they have, these are my comments, what do you think about this, where do you think industry is, where do you think this is going. Within two days they come back to me. I take those plans and give them back to the applied area and I said from here in we are going to be doing it that way. Biofuels has now become an integral part of all the areas, and also ARPA–E, so that all the expertise then comes together in a room and figure out a unified plan and so this is a new way of doing business. I think it is the right way of doing it.

They still have their own particular things, whether short-term, very short-term applied research or helping with deployment or the longer term. They still have their own parts but at least they will know intimately what everybody is doing and they will coordinate it. And there is actually a very nice buzz about that because what people are finding is, there is excellence in little bits and pieces that they hadn't known before. This I something I learned when I was a young science nine years at Bell Labs because as a manager at Bell Labs, that was my job: find out what everybody is doing in the whole organization and then link up a scientist in my group with someone else far away and then let the sparks fly, and so that is what is happening.

Mr. CLARKE. Thank you, Secretary, Mr. Chair.

Chairman HALL. Thank you very much.

Mr. CLARKE. I wonder if I could make one brief point regarding Michigan State University.

Chairman HALL. Without objection.

Mr. CLARKE. Thank you, Mr. Chair. I really appreciate this very much. This is just very brief. It is just a transition on how we can balance, you know, our efforts between research and development and your department has supported—your Office of Science has supported researchers around the country, especially in Michigan. I want to commend the progress of one of the greatest land-grant universities in this country, Michigan State University, its work on the facility for rare isotope beams, and thank you again for your support. How does this proposed budget strike a balance between——

Chairman HALL. The Secretary will give a brief answer.

Secretary CHU. Very, very briefly, the proposed budget wants to support that and get the construction going on that but, you know, it depends on what Congress gives us for the budget. I mean, projects like that would be at risk.

Chairman HALL. Mr. Hultgren of Illinois.

Mr. HULTGREN. Thank you, Mr. Chairman. Thank you, Dr. Chu. I am concerned about the funding for DOE's Office of Science and specifically the high-energy physics program there, which is clearly in a period of transition right now. The Administration has notified Congress it intends to shut down the Tevatron at Fermilab. I met with—and that is ending here in fiscal year 2011. I met with Fermilab many times, and I know that with that record-breaking machine and all that has been accomplished there, Fermilab is ready to transition to new programs, one of them including the Long-Baseline Neutrino Experiment. The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory at the Homestead Mine of South Dakota, as you know. It is my understanding that the President has proposed $32 million for DUSEL and for LBNE in is fiscal year 2012 budget request for DOE. I also understand the department stepped in when it became clear that a new stewardship agreement would be needed between DOE and NSF while a study is conducted and decisions are made on the path forward for these projects.

A couple questions I had just on the situation, and we have talked quite a bit about it, of really the importance of having basic research and all that our laboratories have brought to us. The President's fiscal year 2012 budget request total is $797.2 million for high-energy physics overall. It really does amount to a freeze at the fiscal year 2010 enacted levels when other projects within the Office of Science are slated to increase from 21 to 24 percent. My question is, why is there such an imbalance in the basic research portfolio of the Office of Science?

Secretary CHU. Yeah, that is a tough decision but let me explain what our thinking was on that. First, it does not mean we want to see an end to high-energy physics and also fundamental nuclear physics and cosmology. Those are very, very basic things, and out of that research came amazing things. Just the fact that we have particle accelerators that gave us Singatrons and light sources and neutron sources, actually its roots were in high-energy physics.

Mr. HULTGREN. Right.

Secretary CHU. And so it is a very, very direct connection between what you do in research in one area and how it can transform into science or medical research. Right now, yes, we are closing down the Tevatron. There was a move to keep it open for three additional years because the Large Hadron Collider at Cern had a mishap with their magnets, and they thought that if you keep that machine running for another three years, maybe you can—you know, they are looking for the higs and maybe you can square it under and perhaps discover the higs while they are fixing their machine, and in the end what happened was, the Large Hadron Collider got their machine up and running and in the last several months it was—they were able to tweak it up and tune it up far faster than we thought they could actually get it up. And then if you look at the flots and the number of vents coming out of that machine and the higher energy, then the decision became very clear. You know, you are not on the verge of—they weren't on the verge of anything, and the Large Hadron Collider would blow them away.

So the Department of Energy and the director of the laboratory said we shouldn't do this because this is about $35 million a year to keep it running, we would rather take that money and invest it in the high-intensity frontier, which you also spoke about. This is using a new machine to create a lot of neutrinos to look at the neutrino sector, and we think that that is the right decision because this other machine in Europe is just—would smoke us.

And so we want to continue high-energy research in the United States. I mean, the sad part, as you know, is, you know, we could have maintained leadership in this field had we built the Superconducting Super Collider, the SSC, in Texas, but that is water under the bridge. We still think high-energy physics—and the questions in physics and cosmology are asking the most primal roots of science, what is matter, what is energy, okay, and we think that this is still some of the most exciting frontiers in physics but right now we are trying to figure out, okay, given this big investment in Cern, which we then fund American universities and researchers to go over there, we still need something here in the United States that we can call our own, and we think that this high-intensity frontier is that.

But we are going through a tough decision. The high-energy physics community is wrestling with it themselves, what is the best—we don't want just—you know, this is an austere budget time so we can't just continue funding on a certain level. When the great new thing comes along, then I could easily see us coming back up. But right now, that is the plan.

Mr. HULTGREN. Just quickly, I don't—I think it is—I hope that happens but I think it is difficult now when the top scientists are going to Cern rather than staying here, and I hope that is what could happen.

Mr. Chairman, if I could have just 30 seconds quickly specifically on the LBNE?

I just want to ask you the current status and the commitment, are the resources there to be able to continue with LBNE and also with DUSEL?

Secretary CHU. Well, as you know, very quickly, the NSF actually started this project and we became partners and then the NSF decided not to, and there were three critical experiments that we felt we wanted to have continue but again in these very hard budget times, we are going to try wrestle with—we would like to—it can't be the underground laboratory that was envisioned with both NSF and DOE support but we have a committee now that is assigned to look at what is the best—given whatever budgets we get from Congress, what are the things we can and can't do. And so that committee has just been appointed and they will be reporting back, but they have just been formed. But we would like to see it continue the best we can. Again, this is about money.

Mr. HULTGREN. Thank you. Just in closing, Mr. Chairman, thank you so much, Dr. Chu, and I do really appreciate your statements earlier when times are tight, I do think we have to make sure that we still have that commitment to basic research where the private sector won't necessarily do that work, but this is an important function of government. Thank you very much.

Chairman HALL. I was hoping for a yes or no answer but I didn't get it.

Mr. Luján, we recognize you at this time.

Mr. LUJÁN. Mr. Chairman, I appreciate that. I believe that the appropriate answer would be yes, Mr. Chairman.

With that, Mr. Secretary, I want to thank you for being here as well, and if you will indulge me, I am going to try to get through most of this, Mr. Secretary, and there are a few questions within my remarks, and if we are not able to get to them, if I could ask that maybe we just get a response in writing.

I very much agree with your and President Obama's drive to invest in education and research and development and innovation in order to better position our Nation for the future. Investing in R&D is key. We have heard it time and time again, and especially building off of the closing of my friend that just shared some remarks with us. We know that our Nation's competitiveness and our national security depend on it, and I know you are very well aware of the significant role that the people in my district and the people of the State of New Mexico play in both of these areas. Still, the future benefits and the full benefits of R&D can only be realized by coupling R&D with innovation in the marketplace so that there is a seamless transition from the advances in basic science and new technical capabilities all the way through to new technologies that generate new businesses and new jobs. Other countries are making good use of our scientific advances and we must do better.

I therefore commend you on your efforts with ARPA–E and the hubs to promote innovation in targeted areas of national importance. But there is a need to promote innovation and technology transfer more broadly from the top to the bottom and from the bottom to the top. I along with co-chair Frank Wolf have started the Congressional Technology Transfer Caucus to help educate Members on the important issues and barriers to technology transfer. The Department is home to our Nation's national laboratories which serve as an incredible resource for both developing new technologies from which new businesses and new jobs can spring as well for providing technical assistance to businesses. Yet listening to small business owners and entrepreneurs leads me to believe that there is much room for improvement in the Department's technology transfer activities.

For example, a very few of the Department's Cooperative Research and Development Agreements, otherwise known as CRADAs, which is a common mechanism for private equity to work with the national laboratory to mature technology, are supported even in part by Department funds. Most are 100 percent funded by private equity, which is prohibitively expensive for many small businesses. Furthermore, the private entity is often required to pay out a significant fraction of the cost to the project up front before the work will even begin. This too is prohibitive, and I understand that there is more need for us to support maturation and seed programs by the Federal Government to help spur this innovative and ingenuity aspect of the private sector.

I know that your Technology Transfer Coordinator has been working with Technology Transfer Working Groups on ways to improve the Department's tech transfer activities. One question I have, Mr. Secretary, what specific actions do you expect the Department to take in the next year to invigorate tech transfer activities and to do any of them including dedicating more funds and reducing barriers to small businesses?

Mr. Secretary, recently, as you may be aware, in New Mexico we experienced record-breaking freezing temperatures that caused a significant increase in the peak for natural gas. The increase in demand led to severe disruption in our natural gas distribution system, causing outages across the state. This was coupled with outages in ERCOT and the Texas energy markets. Over 30,000 homes were left without power to heat their homes. Currently FERC is conducting an investigation into this. Considering this crisis, I would like to emphasize the importance of supporting the R&D of natural gas technologies to ensure that the overall security of natural gas deliverability to systems in New Mexico and across the country, especially when we talk about powering our vehicles with this important fuel source.

The recent National Academy of Sciences report, "Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads," makes clear that we must continue our efforts to increase minority participation in STEM. In 2007, underrepresented minorities comprised 33.2 percent of the U.S. college-age population and 26.2 percent of undergraduate enrollment yet only 17.7 percent of those were earning science and engineering bachelor's degrees. I would be interested, Mr. Secretary, on hearing on DOE's plans to develop a diverse pipeline of STEM professionals in the energy sector, especially in light of correspondence both myself and Senator Bingaman's office have shared.

And lastly, Mr. Secretary, I apologize. I am going to have to sit to listen to some other responses. In closing, in your remarks you highlight the need to accelerate creation of jobs from R&D investments by increasing the pace of movement from discovery to the marketplace, and I applaud those. What is the DOE doing to improve and streamline the mechanisms for technology transfer from the national labs, especially to small entrepreneurial companies, other than ARPA–E, which has targeted investments in a small number of companies and technologies? What is DOE's strategy to improve the success rate and engaging in the private sector in a technology transfer earlier in the R&D cycle?

Mr. Chairman, I appreciate the indulgence there.

Mr. Secretary, I look forward to getting those responses but applaud you on your efforts on the emphasis with making sure that we are taking this seriously. Thank you, sir.

Chairman HALL. I thank the gentleman.

Mr. Cravaack, who is going to receive the Nobel Prize for patience, he has been here the entire time, I recognize you, sir.

Mr. CRAVAACK. Thank you very much, sir, I appreciate it, and thank you, I appreciate you coming here today.

I appreciate your comments regarding austere conditions. We are as a country definitely in austere conditions, and I am finding it very difficult to find the relationship between the Department of Energy and Tinkerbell. Put up the ad, please. Thank you very much.

[The information follows:]

You Don't
Need Magic To
Use Energy Wisely
Visit energy.gov/tink
Ad Council
U.S. DEPARTMENT OF
ENERGY
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Mr. CRAVAACK. You have an extensive website geared towards educating children and putting out a pretty extensive website having children talk to their parents about making sure they have Energy Star appliances, programmable digital thermostats and home improvements in animated videos. I think it is called Save Energy with Tinkerbell and Her Friends, which is, you know, I understand it. I am a dad. I get it. But unfortunately, we are at a $1.6 trillion deficit, national debt, and $14 trillion in debt. Right now in your budget you are requesting a 44 percent increase in the office to fund these efforts, according to my calculations. You may be telling me I am wrong here by your face. If these are funded, how do we think—you know, I question your putting a 44 percent increase in a budget on these type of programs when we are in such austere conditions as you noted. Do you have any empirical evidence that would provide that these advertisements actually change habits, parents' behavior and attitudes towards energy consumption?

Secretary CHU. You meant 44 percent increase in this budget?

Mr. CRAVAACK. Correct, in advertising.

Secretary CHU. That I wouldn't know about. Is there empirical evidence? No. We do have backward empirical evidence that advertising to kids to try to get their parents to stop smoking was effective.

Mr. CRAVAACK. Well, like I said, in these austere times I just question whoever put this in the budget, and I question what other things are in the budget.

Switching gears here, what actions do you see, especially with the rise of the Chinese developing a deep-water fleet, if our supply lines were shut down? Would we have enough domestic energy production to be able to counter any type of advancement of foreign power?

Secretary CHU. I am trying to interpret your question. I think your question might have been what would happen if we didn't have access to imported oil or was your question——

Mr. CRAVAACK. Correct me if I wrong. Isn't 70 percent of our oil coming from out of state?

Secretary CHU. No, actually not. The latest number I saw was about 51 percent. It is hovering between 50 and 60 percent.

Mr. CRAVAACK. My question is, if our shipping lanes were shut down, Communist-bloc countries, we believe in maintaining free lanes, they believe in shutting them down. So if we had our free lanes shut down, our sea lanes shut down, would we be able to wage an effective war? Do we have the domestic oil supplies ready to go? Do we have the domestic reservoirs ready to go? Do we have—can we gear up in enough time to defend this country?

Secretary CHU. Well, actually, I think that I don't see that as a real possibility. The United States Navy is by far the most powerful Navy in the world, and so——

Mr. CRAVAACK. You didn't believe in Pearl Harbor, sir, so I would question——

Secretary CHU. No, I believe in Pearl Harbor. I believe it happened.

Mr. CRAVAACK. I am a naval officer, retired, 24 years. This is an option.

Secretary CHU. But I do think certainly keeping the lanes open is part of the Navy's job and it is because of our dependency on foreign oil, and that is actually part of the embedded price of oil, if you will, as you well know.

Mr. CRAVAACK. Yes, sir. My question, though, is if the sea lanes were shut down, would we be able to man our fleet, making sure that we would be able to be mobile enough to counter any threat? And if not, why are we not developing our domestic resources to a point where we can be at that point? And for the record, sir, I would like to submit this for the record.

Chairman HALL. Without objection.

[The information appears in the Appendix:]

Secretary CHU. So very quickly to respond to that, you know, as has been pointed out by numerous people here, we consume 25 percent of the oil and we have two percent of the reserves, and so the way we change this situation is to actually transition and get substitutes for oil in the sense that—and this is a long-term thing so we have got to start immediately but the electrification——

Mr. CRAVAACK. Sir, in our current situation right now, would we be able to man and fuel our fleets if the sea lanes were shut down?

Chairman HALL. A yes or no answer would do.

Secretary CHU. We have a Strategic Petroleum Reserve, which is intended for emergencies like this.

Mr. CRAVAACK. Is it sustainable?

Secretary CHU. I think it is sustainable in enough time for our Navy to clear and open up the sea lanes.

Mr. CRAVAACK. I would beg to differ. Thank you very much for your time.

I appreciate the indulgence. I will yield back my negative balance. Thank you.

Chairman HALL. You don't have a bad negative balance. Some good questions. Thank you.

Mr. Tonko, the gentleman from New York.

Mr. TONKO. Thank you, Chairman Hall, thank you, Ranking Member Johnson, for holding today's hearing, and thank you, Secretary Chu for your leadership and that of our President on clean energy and what you have both described as our "out-innovating" our competitors in a global clean energy race and the need to win that race.

We cannot win the future, however, if we pull the rug out from under our Nation's feet. We cannot afford to go backward, and yet it seems as though that is certainly what the new Majority in this House intends for us to do. According to Mark Zandy, former Presidential candidates John McCain's economic advisor, the C.R. or "so be it" spending bill would destroy some 700,000 jobs. Federal Reserve Chair Ben Bernanke said yesterday that it would cost at least a couple of hundred thousand jobs, a number called "not trivial." So it is with that background that I approach you in this hearing today.

Mr. Secretary, skyrocketing gasoline prices are deeply hurting the American public. In the capital district of New York, consumers are paying at the pump about $3.57 per gallon. Nationally, the average price is about $3.38 per gallon and it continues to rise. Due to the continued conflict in North Africa and the Middle East, oil is now over $100, as you know, per barrel. For every $10-per-barrel rise in the price of oil, America sends an additional $40 billion overseas yearly. Plain and simple, we must start thinking outside the barrel so as to create jobs and protect our national security. We are better than the ancient fuel that we put into our vehicles, and I believe that with Representative Bartlett's presentation he reinforces the efforts to look outside the barrel. Using 19th and 20th century oil subsides in this 21st century economy is outdated and, in my opinion, foolish. We are literally giving away hard-earned taxpayer money to big oil companies, and what we get in return is sticker shock at the pump.

And so instead of cutting subsidies to Big Oil and CEOs that are making record profits, we are cutting funding to science, funding to innovation, to entrepreneurs and to our middle class. The C.R. would slash funding for the Office of Energy Efficiency and Renewable Energy budget by more than 35 percent, rescind *American Recovery and Reinvestment Act* loan guarantee funding for renewable energy projects and cut funding for energy efficiency programs that create jobs and reduce homeowners' energy costs and carbon pollution.

Mr. Secretary, do you think it is wise to continue to provide handouts to big oil companies, especially as prices at the pump continue to skyrocket at a time when we must address our debt and deficit?

Secretary CHU. No, I don't think it is wise. The President has called for an end to the oil subsidies, which by his reckoning is about $3.5 billion a year. But you also have to put that in context, so these are tax break subsidies where the profits of the oil companies in 2010 of just the four or five major oil companies $75 billion. That is the profit, so the revenues are in the hundreds of billions of dollars. So this $3.5 or $3.9 billion subsidy is a little dimple on the overall economics of oil and the cost of oil that I think the American people should recognize. If you are making $75 billion—and those are only the five majors. If you are making $75 billion, if you add them up in total, it could be $100 billion. Three point nine is not a big deal.

And so it won't have an effect on prices, and this is what our program has been in the past two years, you know, higher mileage standards, electrification of vehicles, do everything you can to develop biofuels that would be substitutes for the oil. So we diversify our transportation fuel supply. And when we get electric vehicles or gas vehicles, natural gas-powered vehicles, this is energy produced in the United States so wealth remains in the United States, another big plus. So this is the plan. We have got to decrease our dependency on oil and diversify. Our transportation needs are almost exclusively dependent on oil and we have got to diversify that, otherwise we still will be hostage to these very unstable prices.

Mr. TONKO. Thank you. And according to the office of EERE, the number of fuel cell and hydrogen megawatts shipped by nine U.S. companies has increased by 40 percent in just one year, and yet in my opinion the budget does not provide enough funding for this critical technology. It is a proven technology including some companies within the United States such as those used for forklift applications that are commercially deployed today. In your opinion, is there a role for fuel cells in complementing renewable and traditional fuels?

Secretary CHU. Yes, there are, and we are trying to—these are decisions—especially if you look at forklifts, there are three alternatives. There is natural gas power for forklifts, there is electric vehicles and then there are fuel cells. And so we are looking very closely. All those are lower pollution so especially in a city environment or building environment, they are very clean.

In the longer range, and we are also looking very closely what the automobile manufacturers are doing in fuel cells. It all depends on what the battery technology is because for the longer range, a fuel cell is an option. Ultimately we still have to solve the hydrogen source problem. Right now, most of our hydrogen comes from reforming natural gas, and then you still have the carbon dioxide from that natural gas, and so we are also investing in research that says—very innovative research—sunlight directly into hydrogen in a very low-cost application. If you can do that, then the major hurdle is where are we going to get the hydrogen.

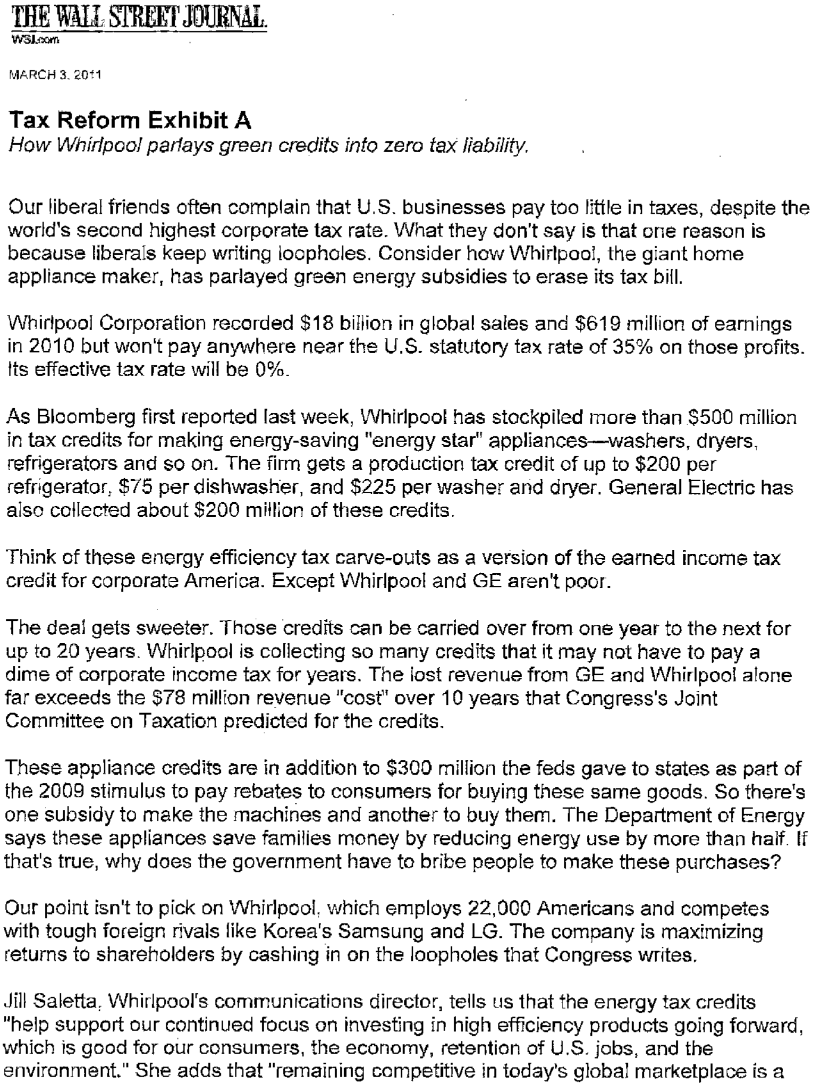
Mr. TONKO. Mr. Chairman, I have a couple other questions that I will enter through the Committee after the hearing.

Chairman HALL. I thank you for it.

Mr. TONKO. Thank you.

Chairman HALL. I would like to submit this article from the Wall Street Journal that describes how companies like Whirlpool and GE have banked enough green energy credits so that they will not have to pay corporate taxes for years. I offer this as a response to the claim that the Administration is not picking winners and losers, particularly when the President suggests increased taxes on oil and gas. Without objection, so ordered.

[The information follows:]



THE WALL STREET JOURNAL.
WSJ.com

MARCH 3, 2011

Tax Reform Exhibit A

How Whirlpool parlays green credits into zero tax liability.

Our liberal friends often complain that U.S. businesses pay too little in taxes, despite the world's second highest corporate tax rate. What they don't say is that one reason is because liberals keep writing loopholes. Consider how Whirlpool, the giant home appliance maker, has parlayed green energy subsidies to erase its tax bill.

Whirlpool Corporation recorded $18 billion in global sales and $619 million of earnings in 2010 but won't pay anywhere near the U.S. statutory tax rate of 35% on those profits. Its effective tax rate will be 0%.

As Bloomberg first reported last week, Whirlpool has stockpiled more than $500 million in tax credits for making energy-saving "energy star" appliances—washers, dryers, refrigerators and so on. The firm gets a production tax credit of up to $200 per refrigerator, $75 per dishwasher, and $225 per washer and dryer. General Electric has also collected about $200 million of these credits.

Think of these energy efficiency tax carve-outs as a version of the earned income tax credit for corporate America. Except Whirlpool and GE aren't poor.

The deal gets sweeter. Those credits can be carried over from one year to the next for up to 20 years. Whirlpool is collecting so many credits that it may not have to pay a dime of corporate income tax for years. The lost revenue from GE and Whirlpool alone far exceeds the $78 million revenue "cost" over 10 years that Congress's Joint Committee on Taxation predicted for the credits.

These appliance credits are in addition to $300 million the feds gave to states as part of the 2009 stimulus to pay rebates to consumers for buying these same goods. So there's one subsidy to make the machines and another to buy them. The Department of Energy says these appliances save families money by reducing energy use by more than half. If that's true, why does the government have to bribe people to make these purchases?

Our point isn't to pick on Whirlpool, which employs 22,000 Americans and competes with tough foreign rivals like Korea's Samsung and LG. The company is maximizing returns to shareholders by cashing in on the loopholes that Congress writes.

Jill Saletta, Whirlpool's communications director, tells us that the energy tax credits "help support our continued focus on investing in high efficiency products going forward, which is good for our consumers, the economy, retention of U.S. jobs, and the environment." She adds that "remaining competitive in today's global marketplace is a top concern for Whirlpool Corporation. Taxes, administrative and other costs are higher in the U.S. than in some other countries."

That's for sure. But such favoritism makes the U.S. tax system even less competitive. Tax credits mean little or no liabilities for firms that win most-favored-tax status in Washington, but companies without the right lobbyists or friends in Congress pay a punitive 35% rate that even Europeans have long since abandoned.

Special favors like these also create a business constituency against tax reform that would benefit the overall economy. Whirlpool carries its $500 million of unused tax credits as an asset on its balance sheet, so cutting tax rates shrinks the book value of that asset. "This is why so many companies actually oppose lowering tax rates," says Scott Hodge, president of the Tax Foundation.

The White House claims to want to reduce corporate tax rates in a "revenue neutral way" by closing loopholes. Yet it's hard to take that commitment seriously when its new budget proposes to extend the green-credit windfall for another year. Whirlpool is one more case study in the case for corporate tax reform.

http://online.wsj.com/article/SB10001424052748704506004576174321393436988.html?KEYWORDS=Tax+Reform+Exhibit+A-How+Whirlpool+parlays+green+credits+into+zero+tax+liability#printMode

Chairman HALL. The chair recognizes Mr. Lipinski.

Mr. LIPINSKI. Thank you, Mr. Chairman. You saved the best until last.

Dr. Chu, I appreciate all your work, especially in these especially difficult times at this point. I know you share my concerns about the rapidly rising costs of our dependence on imported oil, and I think part of the solution to our energy problems is the use of nuclear power along with vehicle electrification. That is why I was particularly interested in a portion of your written testimony that discusses cost-shared activities with industry. It might help accelerate commercial deployment of small modular reactors, and I know that you have answered a number of questions on this and addressed this already, so I just want to say specifically on SMRs, I think the budget is a good start, though I would like to see an even greater commitment to SMRs, but I know this is the first time that DOE has actually—really put an effort and put the funding behind helping to move these forward, and I would like to see more of that in the future.

One other area, though, when it comes to nuclear power that I am concerned about is that much of our skilled workforce is near retirement and this includes skilled tradesmen and -women, technicians as well as scientists and engineers including thousands that work in your agency. So I just want to ask what action is DOE taking to ensure that there is sufficient skilled craftsmen and technicians to build America's clean energy facilities and staff U.S. manufacturing facilities? Do you think that we are doing enough on this?

Secretary CHU. I don't think we are doing enough but I think people enter into job training and enter into, you know—make choices in undergraduate, graduate school based on where they think they can get jobs so ultimately it is very important that the United States show signs that it can restart the nuclear industry domestically at home, which means you build more reactors. We were able to build—over a 20-year period, we essentially started the entire fleet of nuclear reactors we have today, over 100 were started within a 20-year period. There was a long tail of finishing but never mind that. So I think it is clear that the United States is willing to make the investments in nuclear reactors here in the United States, and again, the clean energy standard would be a major driver to allow that to occur because it is a form of clean energy.

Then I think the supply lines, the trades people you talked about, the engineers that would be needed in order to do this, that all becomes part of the process. As long as you see that—and that is why other countries want to stimulate the production of new energy and new energy infrastructure because all those things, then all the manufacturing capabilities are usually built domestically because it doesn't make sense to set up a very long supply chain, especially for the heavy products.

And so the clean energy standard would be the single-most important thing you could say we are serious about reinvesting in the United States power infrastructure and that would include nuclear reactors, and all the other training and everything will follow suit because they say I have a job.

Mr. LIPINSKI. I would like to go further with you on that, but at this moment with the time I have left, I want to ask about one other area. I was excited to see that the President's budget shows a clear commitment to developing a more sustainable industrial sector in the United States as evidenced by the significant increase in the Industrial Technologies Program, which helps manufacturers become more efficient. I know the ITP program, especially the Industries of the Future subprogram, has helped the American steel industry dramatically reduce its energy consumption while increasing production. How would the proposed increase in ITP and similar programs contribute to the long-term viability of manufacturing in our country?

Secretary CHU. I think it would be a great help. I think a number of companies have bitten the bullet either with help from the Federal Government or they did it on their own where energy-intensive companies—Dow Chemical is a perfect example of that where here is a company that—it takes carbon in the form of oil and natural gas typically and converts it into another form of carbon turns plastic, and it is a very heavily energy-intensive transformation from one form of carbon to the other, and so they are able to save tens of millions of dollars a year now by driving to very high efficiencies, Dupont similarly. So many, many companies are realizing you make investments in energy efficiency in their industrial practices and it is really good for the bottom line. I don't know whether it is tens or hundreds of millions of dollars, I forget, but it is a tremendous amount of money, very rapid return in capital, all good things.

And so anything that the United States can do to help companies make the transition to save money by saving energy, it would be a very good thing.

Mr. LIPINSKI. One last thing. As the author of the H-Prize, I was very happy to hear what you said in the answer to the last question about the great potential advances in producing hydrogen besides from natural gas. Thank you again for all your work.

I yield back.

Chairman HALL. Thank you for your yield back, and I certainly thank Dr. Chu for his very valuable testimony and the members for their questions. I apologize for not running a more youthful chair. I will try to do better. And I am going to give Mr. Sarbanes half of my time when we meet on the next occasion here, half of my opening statement to him where he will be assured that he will get to ask questions.

And you have been so generous with your answers. The members of the Committee may have additional questions for you, and if you will, we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments.

Dr. Chu, you and your fine staff are to be certainly thanked for your accommodation of your time and the time it took to prepare and the time it took for you to come over here. I know you have been away from a very valuable job now for the last couple of hours with us, and we thank you. This hearing is——

Ms. JOHNSON. Mr. Chairman.

Chairman HALL. —not adjourned until Mrs. Johnson gets to say what she wants to say.

Ms. JOHNSON. Thank you, Mr. Chairman. I want to thank Dr. Chu, but I would like to request unanimous consent to enter two articles in the record, one by George Will in reference to a scientific engine and one by Morton Kondracke, who talks about the American's seed corn.

Chairman HALL. Without objection, they are admitted.

Ms. JOHNSON. Thank you.

[The information appears in the Apendix:]

Chairman HALL. We are adjourned. Thank you.

Secretary CHU. Thank you, Mr. Chairman.

[Whereupon, at 12:15 p.m., the Committee was adjourned.]

Appendix I:

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Steven Chu, Secretary, Department of Energy

QUESTION FROM REPRESENTATIVE HALL

Budget and Spending Priorities

Q1a. The budget request proposes large increases in funding for solar energy as part of DOE's "SunShot" Initiative. These are in addition to Departmental support for solar technology development through numerous programs, which include the Advanced Research Projects Agency – Energy (ARPA-E), Energy Efficiency and Renewable Energy (EERE), loan guarantees, Energy Frontier Research Centers, and hundreds of millions in Stimulus funding.

How are all these programs coordinated to ensure R&D efforts are efficient and avoid duplication of effort?

A1a. Within SunShot, DOE has a management structure composed of members from the Office of Science Basic Energy Science program (SC/BES), Advanced Research Projects Agency-Energy (ARPA-E), and Energy Efficiency and Renewable Energy (EERE), who discuss all the RD&D and coordination of activities. The participating SunShot programs have complementary approaches to supporting research on solar energy-relevant problems. EERE and ARPA-E research and development projects focus on near-term technological milestones and deliverables in three to five years. SC/BES projects are targeted at improved fundamental scientific understanding of the phenomena or materials. In some cases, the advanced understanding does not immediately result in technological improvements, but identifies a research pathway that is likely to produce revolutionary advances in the technology in the next 10–20 years.

The purpose of SunShot is two-fold:

1. To create a technical program that focuses effort across DOE toward a common goal of achieving grid parity without subsidies: thus becoming competitive with fossil fuel throughout the U.S. and the world by reaching a dollar-a-watt installed system costs

(4–5 cents per kWh equivalent). Reaching this goal will make the U.S. globally competitive within a very large export market, as well as creating jobs within the country.

2. SunShot is not an initiative apart from the existing solar activities in EERE, SC, and ARPA-E. Rather, it is an initiative that coordinates existing activities in DOE to make the whole greater than the sum of the parts by focusing on a common goal to make solar energy competitive with fossil energy without subsidies, domestically and globally. The SunShot initiative leverages the strengths from across DOE to achieve this goal and focuses previously untapped efforts to make the U.S. globally competitive.

One example of this coordination is ongoing power electronics efforts within the Office of Electricity Delivery and Energy Reliability's Smart Grid R&D program as well as EERE and ARPA-E's research. New power electronics are essential if renewable resources—including photovoltaics (PVs)—are to become a significant part of our energy supply. For instance, the energy storage program at ARPA-E, which is developing storage technologies to overcome the intermittency of solar and wind energy, is reviewed in partnership with storage programs within the Office of Electricity Delivery and Energy Reliability to ensure coordination while minimizing overlap in technologies. SunShot will leverage these efforts to help integrate solar electricity from photovoltaics with the grid via low-cost and reliable inverter technologies. Utility scale photovoltaic system costs in 2010 are estimated at $3.40 per watt with power electronics estimated at $0.22

per watt. To achieve $1 per watt for the module, the PV module power electronics costs have to be reduced by a factor of two.

QUESTION FROM REPRESENTATIVE HALL

Budget and Spending Priorities

Q1b. The budget request proposes large increases in funding for solar energy as part of DOE's "SunShot" Initiative. These are in addition to Departmental support for solar technology development through numerous programs, which include the Advanced Research Projects Agency – Energy (ARPA-E), Energy Efficiency and Renewable Energy (EERE), loan guarantees, Energy Frontier Research Centers, and hundreds of millions in Stimulus funding.

Please detail all programs and activities within DOE that support solar energy-related research, development, demonstration, deployment and commercialization (RDDD&C) activities, and detail how the FY 12 budget request would supplement existing programs.

A1b. Solar research and development activities are supported in SC/BES, ARPA-E, and EERE. The programmatic activities in each of these offices are very different, but when combined form a continuum of research efforts from very fundamental scientific discoveries of new phenomena to deployment of new, energy relevant technologies. SC/BES research targets improving fundamental scientific understanding of the physical phenomena and materials related to solar energy utilization. Typically, this research is not specific to a particular kind of solar energy technology, but underpins the entire field. Five of the 46 Energy Frontier Research Centers supported by BES have activities that include an emphasis on research relevant to solar photovoltaics in addition to addressing a fundamental, grand challenge science issue. Proof of concept demonstrations of new materials and new capabilities for improved efficiency in solar photovoltaics that emerge from these activities will be transitioned to EERE so that issues associated with device and system development and with manufacturing and deployment can be addressed. If fundamental technological barriers are identified in this phase of the continuum they may also become the focus of a BES investigation. Feedback between the basic and applied programs will foster success of the initiative. The details for each of the aspects of SunShot are outlined below.

SC/BES: The current SC/BES research portfolio includes programs on physical theory related to solar energy phenomena, new synthesis techniques and discovery of new photovoltaic materials, and development of novel characterization techniques for photovoltaic materials and properties such as transport at the nanoscale. In support of the SunShot initiative, SC/BES requests $8 million in FY 2012 to support new scientific research focused on a crucial technological photovoltaic issue: understanding the fundamental mechanisms associated with the degradation of photovoltaic materials during use, including the role of defects and inhomogeneities in the atomistic structure on performance of photovoltaic materials. Assessments of the properties will provide data not previously available to correlate transport and other critical properties with structural evolution, interface migration and compositional changes. These proposed efforts are directly motivated by issues identified by the DOE technology programs as obstacles to reducing the cost for future solar energy. The research would be selected through a competitive, peer-reviewed process to complement the existing SC/BES research portfolio.

ARPA-E: ARPA-E programs focus on "out-of-the-box" transformational energy research that industry by itself cannot or will not support due to its high risk, but where success would provide dramatic benefits for the Nation. ARPA-E closely coordinates its technology development efforts with other DOE elements. Currently ARPA-E is funding two solar energy projects. One project is developing a novel crystalline silicon wafer manufacturing process that could cut the cost of installed photovoltaic systems in half and reduce wafer capital costs by 80 percent. The other project proposes to develop a solar concentrator using a novel optofluidic system. As part of SunShot, ARPA-E invests in the next generation of power electronics, which will feed into the Smart Grid and Inverter technologies. ARPA-E hosted a public workshop—"Green Electricity Network Integration"—on December 13, 2010, in Arlington, Virginia, to indentify research opportunities. Successful APRA-E projects will also be integrated into EERE deployment activities.

EERE: Within SunShot, programs are organized around technology themes (including Solar Energy Conversion and Energy Storage). The Solar Energy Technology program (SETP) within EERE currently supports R&D focused on new and emerging solar energy materials and devices, in addition to manufacturing and cost reduction to achieve specific market goals. The research addresses photovoltaic arrays, balance of systems technologies, concentrating solar power systems, and soft costs of deployment such as siting and permitting. In FY 2012, EERE will be enhancing efforts to achieve the dollar-a-watt SunShot objective through an integrated program conducted through the national laboratories, industry, and universities as well as other relevant government offices at the federal, state and local level. SunShot itself aims to reach cost parity with baseload energy rates, increase solar photovoltaic market share for the U.S., boost domestic solar manufacturing and greatly reduce greenhouse gas emissions. The approach consists of two to three years of "horizontal" research and development work focused on reducing

PV modules, power electronics, and balance-of-system costs. This will be followed by two to three years of intense "vertically integrated" systems-level demonstration projects to demonstrate the commercial viability of the approach. The EERE budget for SunShot activities in FY 2011 is $263.5 million. The request for FY 2012 is $475 million.

QUESTION FROM REPRESENTATIVE HALL

Budget and Spending Priorities

Q2a. Similarly, battery and energy storage RDDD&C is funded through numerous programs throughout DOE, and the Administration is proposing to create a new batteries hub as well as increase existing programs.

How are all of these programs coordinated to ensure R&D efforts are efficient and avoid duplication of effort?

A2a. The central mechanism for coordination of battery and energy storage-related R&D efforts is DOE headquarters Energy Storage Working Group. This group is comprised of representatives from each program that supports batteries or other energy storage research: the Office of Electricity Delivery and Reliability (OE), Energy Efficiency and Renewable Energy (EERE), and the Office of Science's Basic Energy Sciences (program (SC/BES). The group's primary functions are coordination of current research, strategic planning, and linking existing researchers to facilitate the information sharing and coordination across the basic science – technology deployment continuum. This group, led by the Assistant Secretary of Office of Electricity Delivery and Energy Reliability (OE), meets regularly and supplements the historic coordination interactions between the various programs, which has included planning of joint workshops, mutual participation in peer reviews, cooperation/coordination of SBIR solicitations, and holding of joint principal investigator meetings. All of these actions ensure a thorough mutual understanding of the work funded by each Office and drive proper delineation and separation of research and goals.

The different programs within DOE are coordinated by their individual focuses to ensure efficiency and avoid duplication. With regard to transportation, the Office of Science researches basic science, like the electrochemistry of metal-oxygen reactions as well as lithium reactions and transport in variety of intercalation compounds. This creates the critical knowledge base for all of the applied programs. The Office of Energy Efficiency and Renewable Energy is focusing on making the current technology, the Lithium-Ion battery, safer, cheaper, and more efficient. ARPA-E is funding projects that seek to make the Lithium-Ion battery obsolete. These projects are researching new metal-air (Li-Air; Zn-Air; Al-Air, etc) battery devices, systems for automobile market that are ten times better in cost-performance metrics than today's Li-ion systems.

This coordination and organization is similar with respect to grid storage. BES creates the knowledge necessary for grid storage technology research. The Office of Electricity works to make the grid more efficient, and ARPA-E focuses on transformational developments in grid-storage technology.

QUESTION FROM REPRESENTATIVE HALL

Budget and Spending Priorities

Q2b. Similarly, battery and energy storage RDDD&C is funded through numerous programs throughout DOE, and the Administration is proposing to create a new batteries hub as well as increase existing programs.

Please detail all programs and activities within DOE that support battery and energy storage-related R&D, and detail how the FY 12 budget request would supplement existing programs.

A2b. The Office of Science/Basic Energy Sciences (SC/BES) currently supports fundamental scientific research on enabling materials primarily through the Energy Frontiers Research Centers (EFRCs). Six of the 46 EFRCs have a strong focus on basic research that will impact energy storage. The goal for SC/BES research is to develop a scientific understanding of the physical phenomena that enable energy storage; the research focuses on developing the scientific knowledge base that will impact a broad spectrum of technologies and will enable new innovations and applications, with a 10–20 year horizon.

The Office of Energy Efficiency and Renewable Energy (EERE) battery R&D is primarily focused on applied development and demonstration of advanced batteries to enable electric drive vehicles.

The Office of Electricity Delivery and Energy Reliability (OE) conducts applied research and field tests focused on lowering the cost and improving the performance of stationary energy storage technologies for utility-scale applications. Technology areas include advanced batteries, flow batteries, flywheels, and compressed air energy. Application areas involve frequency regulation, ramping control, peak shifting, and integration of variable renewable energy resources.

The Advanced Research Projects Agency-Energy (ARPA-E) conducts high-risk transformational research on potentially revolutionary energy storage technologies with a short term time horizon. Research topics are focused by specific solicitations that are developed in concert with the community to identify areas of opportunity. ARPA-E battery and energy storage research includes completed solicitations on Batteries for Electrical Energy Storage in Transportation and Grid-Scale Rampable Intermittent Dispatchable Storage.

ARPA-E coordinates its technology development efforts with other DOE elements. ARPA-E solicits input from other DOE elements to develop programs, uses DOE personnel as reviewers for applications, and consults with other DOE elements regarding ongoing projects.

ARPA-E's Batteries for Electrical Energy Storage in Transportation (BEEST) program seeks to develop a new generation of ultra-high energy density, low-cost battery technologies for long range plug-in hybrid electric vehicles and electric vehicles (EVs). The development of high energy, low cost batteries represents the critical barrier to wide-spread deployment of EVs. If successful, new battery technologies developed under this program will give electrified light-duty vehicles the range, performance, lifetime, and cost required to shift transportation energy from oil to the domestically powered U.S.

electric grid. ARPA-E's objective is to fund high-risk, high reward research efforts that will promote U.S. leadership in this emerging EV battery market.

ARPA-E's Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS) program seeks to develop new technologies that enable widespread use of cost-effective grid-scale energy storage. While valuable applications for grid-scale storage exist, GRIDS focuses on technologies that balance the short-duration variability in renewable generation. Specifically, GRIDS considers two areas: proof–of-concept storage-component projects focused on validating new, over-the-horizon, electrical energy storage concepts and advanced system prototypes that address critical shortcomings of existing grid-scale energy storage technologies.

ARPA-E is also undertaking a novel alternative storage approach in its Electrofuels program, which seeks to use novel microorganisms to harness chemical or electrical energy to convert carbon dioxide into liquid fuels.

Also, in its first Funding Opportunity Announcement (FOA), ARPA-E funded a handful of Direct Solar Fuels projects. Like Electrofuels, the fuels created are forms of energy storage. In April, ARPA-E announced a new FOA called High Energy Advanced Thermal Storage (HEATS) which is seeking technologies to store the "waste" heat created by current energy technologies.

For FY 2012, DOE will support a balanced battery and energy storage portfolio that spans from basic research to applied technology development. Included in the request is $34 million for the Batteries and Energy Storage Energy Innovation Hub to be managed by SC/BES. The Hub will provide an interdisciplinary, unified research framework for electrochemical energy storage research, bringing fundamental and applied research teams together in a single coherent research effort that will accelerate fundamental understanding, materials discovery, and progress towards commercialization of new energy storage technologies. The Batteries and Energy Storage Hub will serve as a source of new understanding of energy storage phenomena. To insure integration within the broader community, the Hub will be a participant in energy storage principal investigator meetings across DOE. The Hub will be an interaction, information, and communication nucleus for the basic and applied battery and energy storage communities—people and information will flow into it and from it to ensure that the problems and issues being faced in today's technologies are understood and to ensure that Hub research will spur innovation and problem solving broadly. The Hub's ultimate technological goals go well beyond currently supported research and include the development of radically new concepts for producing storage devices from materials that are abundant with low manufacturing cost, and have high energy densities, long cycle lifetimes, and high safety and abuse tolerance for a broad range of energy storage applications.

A proposed increase of $59.8 million within the EERE Vehicle Technologies program in FY 2012 will be used to support the Battery Readiness Initiative to move mature battery technologies closer to market entry by supporting scale-up and pilot production, and by accelerating the development of advanced battery computer aided engineering tools.

FY 2012 work in OE will support applied research on near-commercial grid storage technologies and performance testing at the bench and field level, including a new suite of cost-shared grid-scale demonstration projects. Activities also include studies of used electric vehicle batteries for possible re-use in stationary community energy storage systems and development of new methods for identifying new locations for pumped hydro and large scale compressed air energy storage systems.

QUESTION FROM REPRESENTATIVE HALL

Budget and Spending Priorities

Q3. In order to allow the Committee to better review and assess relevant program spending, please provide a list of all active spending on grants, contracts, cooperative agreements, loan guarantees, cash prizes, and "other transactions" awards supported by the following offices; Office of Science, ARPA-E, EERE, Fossil Energy (FE), Electric Delivery and Energy Reliability (OE), Nuclear Energy (NE), and Loan Guarantee Program (LPO).

A3. The table below provides details on FY 2010 costing (financial accruals) for the requested programs across 9 Award Types. DOE and other agencies track funds across Contracts and Orders, Cooperative Agreement, Discretionary Grant, Formula and Block Grant, Other, Unavailable, Grant, Guaranteed Loan, and Direct Loan. These award types are also reported into USASpending.

Through several Acts, including the Energy Policy Act of 2005 (sections 1007 and 1008) DOE was granted the authority to issue prizes. DOE has several categories of prize authority that can be issued. DOE does not keep corporate records of prizes, though for FY11 to date, only the Science program is known to have issued funds for prizes, including Fermi Awards, Lawrence Awards, and PECASE Awards. They are long-standing recognition prizes, rather than inducement prizes, and are duly budgeted for witl program funds.

DOE Costing in FY10 by Award Type for Select Programs
(as of end of September 2010)

	Base Costs ($K)	ARRA Costs ($K)	Total Costs ($K)
SC	**4,406,517**	**599,122**	**5,005,638**
Grants	647,610	67,174	714,785
Contracts	3,391,256	505,757	3,897,013
Cooperative Agreements	153,622	26,158	179,779
Loans	-	-	-
Other	214,029	32	214,061

ARPA-E	**2,570**	**33,856**	**36,426**
Grants	-	-	-
Contracts	361	5,839	6,200
Cooperative Agreements	-	25,575	25,575
Loans	-	-	-
Other	2,209	2,442	4,651
EERE	**1,704,589**	**3,683,250**	**5,387,839**
Grants	406,394	3,337,851	3,744,246
Contracts	895,410	193,735	1,089,146
Cooperative Agreements	260,584	96,556	357,140
Loans	-	-	-
Other	142,200	55,107	197,308
FE	**889,114**	**93,849**	**982,963**
Grants	4,026	2,799	6,825
Contracts	462,626	3,242	465,869
Cooperative Agreements	304,690	83,358	388,048
Loans	-	-	-
Other	117,771	4,450	122,221
OE	**126,521**	**461,353**	**587,873**
Grants	9,503	409,994	419,497
Contracts	78,136	11,154	89,291
Cooperative Agreements	19,794	32,613	52,407
Loans	-	-	-
Other	19,087	7,591	26,678
NE	**1,046,016**	**-**	**1,046,016**
Grants	17,637	-	17,637
Contracts	756,084	-	756,084
Cooperative Agreements	132,699	-	132,699
Loans	-	-	-
Other	139,595	-	139,595
LGPO	**789,387**	**55,570**	**844,957**
Grants	-	-	-
Contracts	29,911	15,297	45,208
Cooperative Agreements	-	-	-
Loans	-	-	-
Other	759,476	40,273	799,749
TOTAL	8,964,713	4,926,999	13,891,712

QUESTION FROM REPRESENTATIVE HALL

Budget and Spending Priorities

Q4. Additionally, please provide a breakdown of funding by R&D maturity level for each DOE Office (examples provided in tables below). For example, in each of years FY 2009 through FY 2012, list historical and anticipated spending for basic research, applied research, technology development, demonstration, commercialization, and non-RDD&D activities, such as education and outreach.

Basic Research

DOE Office	FY 2009	FY 2010	FY 2011	FY 2012 request
Science				
OE				
NE				
FE				
EERE				
ARPA-E				
LPO				

Applied Research

DOE Office	FY 2009	FY 2010	FY 2011	FY 2012 request
Science				
OE				
NE				
FE				
EERE				
ARPA-E				
LPO				

Technology Development

DOE Office	FY 2009	FY 2010	FY 2011	FY 2012 request
Science				
OE				
NE				
FE				
EERE				
ARPA-E				
LPO				

Demonstration

DOE Office	FY 2009	FY 2010	FY 2011	FY 2012 request
Science				
OE				
NE				
FE				
EERE				
ARPA-E				
LPO				

Technology Development

DOE Office	FY 2009	FY 2010	FY 2011	FY 2012 request
Science				
OE				
NE				
FE				
EERE				
ARPA-E				
LPO				

Commercialization

DOE Office	FY 2009	FY 2010	FY 2011	FY 2012 request
Science				
OE				
NE				
FE				
EERE				
ARPA-E				
LPO				

Education and Outreach

DOE Office	FY 2009	FY 2010	FY 2011	FY 2012 request
Science				
OE				
NE				
FE				
EERE				
ARPA-E				
LPO				

A4. Due to the breadth and scope of this question, and the level of analysis needed to supply a complete answer, response to this question will take additional time. We have currently undertaken a Department wide data collection and will be forthcoming to the Committee as this information becomes available.

QUESTION FROM REPRESENTATIVE HALL

Budget and Spending Priorities

Q5. Please provide the Committee a detailed list, including specific awards and contracts, of how much money DOE is spending (1) to develop children's computer games; (2) on energy efficiency public service announcements and related ads, and; (3) on all energy related advertising and marketing activities.

A5. ARPA-E has awarded a project to Stanford University to study how people make decisions about energy. 'Gamification' is a growing area in behavioral science. It uses aspects of traditional games, such as leader boards, achievement levels, user competition, etc. to make learning a new topic more interactive in fun. Stanford's research combines behavioral approaches, product design, computation, and technology to encourage people to be more energy efficient at home, with a long term goal of reducing average residential energy use by over 20 percent. One of the sub-projects at Stanford is development and initial testing of a game in which the user interacts with family members in their home during the course of a normal day. The user must turn appliances on and off and is penalized if these appliances run too long. The game interacts with real-world smart meters, so that a person's behavior in real life affects their standing in the game.

Below is a list of the Office of Energy Efficiency and Renewable Energy's (EERE) Office of Communications and Outreach's awards and planned awards for public service ads and materials and exhibits for events for Fiscal Years (FY) 2009-2012. Included in this list are projects such as the Tinkerbell campaign, where the Department partnered with Disney to use the Tinkerbell character to promote energy efficiency. The Tinkerbell campaign promoted energy efficiency and received $24 million in donated media space in TV, radio, billboards, and other venues. During the hearing, a question was raised regarding the Department's expenditure of funds for the Tinkerbell ad campaign, and an assertion was made that the Department has been spending large sums on such a campaign. Disney provided all the creative work at no cost to the government and provided $100,000 for production and distribution costs. The Department paid about $93,000 from calendar year 2008 through calendar year 2010 for distribution costs.

Sub-program or activity	**Award name / Contract**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	
DOE Office of ARPA-E	**Stanford University**	**0**	**$50**	**$50**	**50**	**Expenditures for Computer Games related to Energy Efficiency ($ in Thousands, FY10, FY11 and FY12 are estimates)**
DOE Office of EERE	Ad Council	$757.7	$311.2	$1,600.0	$700.0	**Expenditures for Public Service Ads related to Energy Efficiency ($ in Thousands, FY11 and FY12 are estimates)**
	Sentech/SRA International	$225.0	$650.0	$600.0	$450.0	**Exhibits and materials ($ in Thousands, estimates)**
	To Be Determined			$200.0	$200.0	**Expenditures for Public Service Ads related to Energy Efficiency ($ in Thousands, estimates)**

QUESTION FROM REPRESENTATIVE HALL

Openness and Transparency

Q6a. President Obama has committed to making his Administration the most open and transparent in history. In spite of this promise, transparency appears lacking in parts of DOE. The lack of transparency at EERE in particular is troubling. With billions of dollars awarded to hundreds if not thousands of entities, transparency is vital.

What steps is DOE taking to increase accountability and provide transparency throughout the Department? What specific steps within EERE are you taking to increase transparency?

A6a. The Administration is committed to transparency, and EERE has taken numerous steps to improve communication of how program funds are being used. The EEREs News page on our web site announces every funding opportunity announcement as well as the selections for funding that are made (see http://apps1.eere.energy.gov/news).

Additionally, EERE publishes the evaluation criteria and scoring methods for every solicitation or competition prior to any applicant preparing or submitting their application (see http://www1.eere.energy.gov/financing). With respect to EERE's $16.8 billion in Recovery Act funding, the public can directly access recipient-level information on each of the more than 3,000 awards that were made, as well as track the weekly financial status of those funds as they are obligated and outlaid (see http://www.energy.gov/recovery/data.htm).

The recipients of EERE Recovery Act awards also report on the number of jobs that are funded with Recovery Act dollars each quarter following OMB guidance[1], and these data can be found on www.recovery.gov. Further, EERE has fully cooperated with and provided transparent information on its programs and status of funds to both the DOE Inspector General (IG) and the Government Accountability Office (GAO). Since the beginning of the Recovery Act, EERE has been the subject of or featured in approximately 50 IG and GAO reports. In December 2010, EERE also launched a blog that features key lessons learned from monitoring our Recovery Act portfolio of projects (see http://www.eereblogs.energy.gov/lessonslearned/).

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[1] http://www.whitehouse.gov/sites/default/files/omb/assets/memoranda_2010/m10-08.pdf

QUESTION FROM REPRESENTATIVE HALL

Openness and Transparency

Q6b. President Obama has committed to making his Administration the most open and transparent in history. In spite of this promise, transparency appears lacking in parts of DOE. The lack of transparency at EERE in particular is troubling. With billions of dollars awarded to hundreds if not thousands of entities, transparency is vital.

Will you commit to taking tangible, near-term steps throughout DOE to make individual award decisions publicly available in a easily navigable format?

A6b. The Administration is committed to transparency, and EERE has taken numerous steps to improve communication of how program funds are being used. EERE's news page on our web site announces every funding opportunity announcement as well as the selections for funding that are made (see http://apps1.eere.energy.gov/news).

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[2] http://www.whitehouse.gov/sites/default/files/omb/assets/memoranda_2010/m10-08.pdf

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QUESTION FROM REPRESENTATIVE HALL

DOE Employment

Q7. Please provide information regarding staffing status and trends throughout DOE R&D programs, including the number of Schedule C, and SES political appointees as well as career civil servants and contractors as indicated in the following sample table:

A7. *Schedule C appointees/SES appointees/career civil servants/contractors*

DOE OFFICE	APPT TYPE	FY09 (9/30/2009)	FY10 (9/30/2010)	FY11 (3/31/2011)	FY12 Request
Science	Pres Appoint	1	1	1	1
	Non Career SES	-	-	-	-
	Schedule C	1	2	1	2
	Federal Employee	1,041	1,039	1,020	1,132
	Contractor	23510	Not Available	Not Available	Not Available
				*DOE National Labs are contractors	
Fossil Energy	Pres Appoint	1	1	-	1
	Non Career SES	-	2	2	2
	Schedule C	-	2	-	2
	Federal Employee	816	838	821	839
	Contractor	700	1063	817	735
Nuclear Energy	Pres Appoint	1	1	-	1
	Non Career SES	1	1	1	1
	Schedule C	-	1	1	1
	Federal Employee	354	351	368	423
	Contractor	-	16	14	Not Available
Energy Efficiency	Pres Appoint	1	-	1	1
	Non Career SES	1	1	1	1
	Schedule C	4	1	4	4
	Federal Employee	554	687	750	818
	Contractor	1443	Not Available	Not Available	Not Available
Electricity Delivery	Pres Appoint	-	1	1	1
	Non Career SES	-	-	-	-
	Schedule C	1	1	1	1
	Federal Employee	71	83	73	88
	Contractor	-	Not Available	Not Available	Not Available
ARPA-E	Pres Appoint		1	1	1
	Non Career SES	-	-	-	-
	Schedule C	-	-	-	-
	Federal Employee	3	19	24	38
	Contractor	8	39	34	72

QUESTION FROM REPRESENTATIVE HALL

DOE Employment

Q8. Please provide a listing of all support contractor organizations used for FY2009, FY2010, and FY2011, and the funding each has received from the Offices of Science, EERE, OE, NE, FE, ARPA-E, and LPO.

A8. Attached is a list of the contracts that fall within the following Product Service Codes used in the Federal Procurement Data System. These codes indicate various types of support services. The list indicates the funding obligated on those contracts from the Office of Science, EERE, OE, NE, FE, ARPA-E, and LPO.

Some of the information we are providing in response to your questions is information that would not be available to a member of the public because it would violate the privacy rights of individuals not employed by the Federal government. Additionally, some portions of the information may be similarly protected by other legal considerations which would preclude its disclosure to members of the public.

The list should therefore be handled accordingly.

B - Special Studies and Analyses - Not R&D
D - Automatic Data Processing and Telecommunication
F - Natural Resources and Conservation
G - Social Services
H - Quality Control, Testing, and Inspection
J - Maintenance, Repair, and Rebuilding of Equipment
K - Modification of Equipment
L - Technical Representative
N - Installation of Equipment
P - Salvage Services
Q - Medical Services
R - Professional, Administrative and Management Support
S - Utilities and Housekeeping Services
T - Photographic, Mapping, Printing, and Publications
U - Education and Training
V - Transportation, Travel and Relocation

QUESTION FROM REPRESENTATIVE HALL

DOE Employment

Q9. Please provide a list of ARPA-E employee and contractor salaries (without individual names) and a description of how ARPA-E has used its special hiring authority to meet staffing needs.

A9. ARPA-E has used its special hiring authority to quickly hire scientific, engineering, and professional personnel pursuant to its statute. ARPA-E has used this authority to hire eleven people, including scientists and engineers, to serve limited terms as Program Directors and Fellows.

Regarding ARPA-E employee salaries, because of the small number of federal staff at ARPA-E we believe that if individual salaries are listed, even without names, one would be able to deduce the salaries of individual people. The Committee can be assured that no one at ARPA-E is earning more than the maximum amount allowed by law. In addition to the eleven people hired under the special authority referred to in the first paragraph, ARPA-E has ten employees hired under the General Schedule and our Director who is presidentially appointed and Senate confirmed. We would be happy to provide this information in another forum.

Regarding the contractor salaries, the requested information is proprietary and could not be publicly disclosed without adversely impacting the competitive position of the firm that is providing support services to ARPA-E.

QUESTION FROM REPRESENTATIVE HALL

ARPA-E

Q10a. The 2007 law authorizing ARPA-E sets clear boundaries on the type of R&D that should be funded-explicitly directing ARPA-E to fund "areas that industry by itself is not likely to undertake because of technical or financial uncertainty."

Do you support this basic principle to limit taxpayer funding to technology areas that industry is not pursuing?

A10a. ARPA-E supports its statutory mission to accelerate "transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty." ARPA-E is careful to not fund any specific and discrete technical idea that had previously received money from industry. ARPA-E sets market-based cost and performance metrics in technology areas that if met would displace the prevailing technology. ARPA-E is technology agnostic and selects among competing new technologies based upon their potential to meet our cost and performance metrics. ARPA-E seeks to create competition between performers. We expect that many of the projects will fail, but of those that are successful in the research phase the market must dictate which projects will ultimately succeed. In that sense, ARPA-E does not pick winners - we set the metrics, create the competition, and let the market pick the winners.

QUESTION FROM REPRESENTATIVE HALL

ARPA-E

Q10b. The 2007 law authorizing ARPA-E sets clear boundaries on the type of R&D that should be funded-explicitly directing ARPA-E to fund "areas that industry by itself is not likely to undertake because of technical or financial uncertainty."

Are you concerned that DOE spending on industry projects may simply supplant or even crowd out private investment? How does the Department assess and evaluate relevant private sector investment when considering applicant proposals for R&D funding?

A10b. At ARPA-E, we seek to make investments in transformational energy technologies that private sector investors are not likely to fund at their present stage of development. ARPA-E investments have both high technical risk and high market risk. Private capital generally undertakes projects with minimal technical risk. It is extremely rare for private capital to finance projects that have high technical risk and high market risk. As such, ARPA-E does not fund specific and discrete technical ideas that have previously received private sector funding.

ARPA-E continually assesses private sector investment in specific fields and technology areas by meeting and communicating regularly with venture capitalists and other private investors to get a sense of their appetite for risk and the types of projects they are funding and not funding. In addition, ARPA-E hires Program Directors with backgrounds in science and business in order to make more precise determinations of the types of high risk projects that are appropriate for ARPA-E to fund. This expertise, along with the ongoing assessments, is used to make evaluations and inform decisions in regard to applicant proposals.

1366 Technologies in Massachusetts exemplifies the role that ARPA-E plays. 1366 Technologies seeks to drive down the cost of electricity generated from sunlight using photovoltaics. However, 1366 Technologies was unable to draw the necessary investment from the private sector community to perform the early-stage research to test this idea. Five years ago, an idea like this would likely have been left on the drawing board by the private sector because of the high risk. However, using ARPA-E's financial support, 1366 Technologies is developing a wafer manufacturing process that plucks wafers directly from molten silicon and, if successful, could cut the cost of installed photovoltaic systems in half and reduce wafer capital costs by 90 percent. 1366 Technologies was able to leverage a $4 million investment from ARPA-E along with $6.5M from the DOE Solar Program to secure an additional $33.4 million from investors and interested customers.

1366 Technologies is just one example of ARPA-E catalyzing the private sector to invest in technologies that, without ARPA-E's contribution, would likely have been considered too risky. Six projects funded by ARPA-E, at a level of $24 million in 2010, have received over $100 million in private sector follow-on funding. Overall, ARPA-E projects have garnered over $260 million in such follow-on funding. ARPA-E's initial funding was used to address technical barriers, and ARPA-E uses the expertise of its staff, and the access it has to the full technical expertise of the Department and its labs to carry out technical vetting of high risk technology ideas.

ARPA-E also invests in the development of enabling technologies (e.g., electric grid-scale energy storage, power electronics) that are not attractive for private capital as they are not suitable for a quick return on investment.

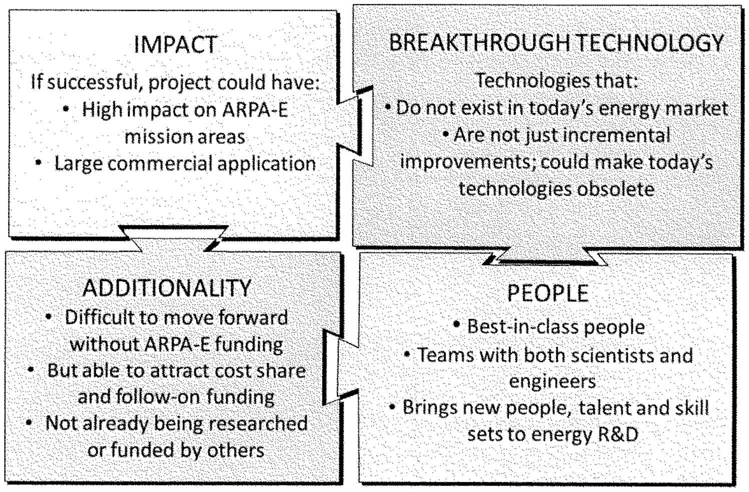
QUESTION FROM REPRESENTATIVE HALL

ARPA-E

Q10c. The 2007 law authorizing ARPA-E sets clear boundaries on the type of R&D that should be funded-explicitly directing ARPA-E to fund "areas that industry by itself is not likely to undertake because of technical or financial uncertainty."

What safeguards and criteria are in place to ensure DOE funding only is disbursed to projects not already being pursued by the private sector?

A10c. The safeguards and criteria in place to ensure DOE funding is only disbursed to projects not already being pursued by the private sector include: the nature of the projects ARPA-E funds, the type of Program Directors recruited, ARPA-E's rigorous program development process, and mandatory disclosure requirements for applicants.



IMPACT

If successful, project could have:

- High impact on ARPA-E mission areas
- Large commercial application

BREAKTHROUGH TECHNOLOGY

Technologies that:

- Do not exist in today's energy market
- Are not just incremental improvements; could make today's technologies obsolete

ADDITIONALITY

- Difficult to move forward without ARPA-E funding
- But able to attract cost share and follow-on funding
- Not already being researched or funded by others

PEOPLE

- Best-in-class people
- Teams with both scientists and engineers
- Brings new people, talent and skill sets to energy R&D

At ARPA-E, we seek to choose projects that make investments in early-stage, transformational energy technologies and have both high technical risk and high market risk. Private capital generally undertakes projects with minimal technical risk. It is extremely rare for private capital to finance projects that have high technical risk and high market risk.

ARPA-E hires Program Directors with a background in science and industry in order to make more precise determinations of the types of high risk projects that are appropriate for ARPA-E to fund.

ARPA-E has a rigorous program development process. Before announcing a program, ARPA-E undertakes a comprehensive process to ensure that it is locating a "white space" that is not being addressed by the private sector. ARPA-E technical staff review existing literature to identify potential program areas. From here, ARPA-E technical staff undertake "deep dive" research into specific potential program areas to determine the current state of the art, the main players in this space, the major technology challenges, and, most critically, whether there is significant technology white space for a high-impact ARPA-E program. From there, ARPA-E will hold a workshop, bringing in the relevant players from industry, academia, and government to further refine concepts for potential programs. Program Directors connect with the business world and lead a competitive, thorough review process to fund projects not being funded by the private sector.

In addition, each applicant for ARPA-E funding must fully disclose all sources of funding (past, current, or pending) for all potentially related or identical projects. Once the award is issued, recipients are required to fully disclose any additional funding that it receives from any public or private source. This ensures transparency and enables ARPA-E to make appropriate funding determinations.

ARPA-E

QUESTION FROM REPRESENTATIVE HALL

Q10d. The 2007 law authorizing ARPA-E sets clear boundaries on the type of R&D that should be funded-explicitly directing ARPA-E to fund "areas that industry by itself is not likely to undertake because of technical or financial uncertainty."

Recent ARPA-E efforts have called attention to highly-qualified applicants that did not receive ARPA-E awards. Please detail the results of DOE efforts through the ARPA-E summit and other means to encourage these applicants to receive private investment or other governmental support.

A10d. ARPA-E is committed to doing all it can to see promising technologies succeed, whether they are funded by ARPA-E, or not.

ARPA-E has published a list of "encouraged applicants" on its website, along with information about their technologies. "Encouraged applicants" are highly-qualified, promising applications that did not receive ARPA-E awards. (This is an "opt-in" list, so "encouraged applicants" are only listed if they consented to participate.) Through this list, ARPA-E intends to facilitate communication between "encouraged applicants" and potential investors, partners, and customers and accelerate technology development. "Encouraged applicants" also have the option to place an electronic badge on their websites indicating that they are an "encouraged applicant" to an ARPA-E funding opportunity, which provides some measure of third-party validation of their technological efforts.

ARPA-E invites "encouraged applicants" to participate in meetings with recipients, program reviews, and other events in order to facilitate the exchange of technical information and spur new collaborations and partnerships. ARPA-E's "encouraged applicants" are invited to participate in upcoming workshops, as well as to come to Washington to meet with ARPA-E personnel.

ARPA-E invited all of these "encouraged applicants" to join with ARPA-E recipients in showcasing their advanced energy technologies at the ARPA-E Energy Innovation Summits in 2010 and 2011. Nearly 1,700 people attended the 2010 Summit and approximately 2,100 people attended the 2011 Summit, including hundreds of venture capitalists and other private investors. Investors are especially interested in ARPA-E recipients and "encouraged applicants" because of the rigor of ARPA-E's scientific merit review process. Approximately 50 "encouraged applicants" showcased their technologies at the 2011 Summit. Approximately two-thirds of the companies showcasing their technologies, including many of the "encouraged applicants," benefited from one-on-one meetings with investors and industry. ARPA-E recognizes that private capital is absolutely necessary to ensure commercialization of these early-stage technologies, and it continues to strengthen the relationship with the private investment community by publicly showcasing our investments and non-investments.

QUESTION FROM REPRESENTATIVE HALL

Q11. What ARPA-E projects awarded funding have contracts under "other transactions" authority? What concessions did ARPA-E make for those projects and what did ARPA-E receive in return for those concessions?

A11. The U.S. Department of Energy (DOE) first received "other transactions" authority in the Energy Policy Act of 2005 (EPACT 2005). As required by EPACT 2005, DOE developed and issued final regulations to implement other transactions authority before using the authority. These regulations are codified at 10 C.F.R. Part 603. Furthermore, DOE issued supplemental guidance and developed and presented training on how to use the other transactions authority to DOE legal, procurement, and program office officials. DOE decided to implement other transactions authority by using a special type of financial assistance instrument, called Technology Investment Agreements (TIAs). In addition, DOE developed a training course on how to use this new type of agreement and presented the course at headquarters and field locations where TIAs were most likely to be used. The Government Accountability Office reviewed DOE's TIA regulations in 2008, and concluded that "the controls DOE put into place over the use of its other transactions authority appear to be adequate, assuming that DOE continues to effectively implement the safeguards and to incorporate lessons learned as the department negotiates future agreements." GAO, *Department of Energy: Implementation and Use of Other Transactions Authority Provided in the Energy Policy Act of 2005* (June 6, 2008).

ARPA-E worked closely with DOE procurement and intellectual property counsel to negotiate three TIAs under the first ARPA-E funding opportunity. In each case, ARPA-E obtained a greater cost share commitment by the recipient (50% of the total project cost compared to the 20% minimum required by EPACT 2005 for R&D project). For each TIA, the only standard provisions that were modified were intellectual property provisions. These modifications were made to ensure the further development, deployment, and commercialization of the resulting technologies.

Under a standard grant or cooperative agreement, the recipient may elect to retain title to its "subject inventions" (i.e., inventions conceived or first actually reduced to practice under the award), but the government retains certain rights in those inventions. Two principal rights are: (1) a government license, and (2) "march-in" rights. The government license is a royalty-free, nonexclusive license to practice, or have practiced on behalf of the United States, subject inventions. Through "march-in rights," the Federal Government may require the recipient to grant a license to third parties for the use of a subject invention when the recipient has not taken effective steps to commercialize the technology within a reasonable time.

ARPA-E negotiated two TIAs with small businesses that were concerned about the potentially adverse impact of the government license and march-in rights on their ability to attract additional capital to commercialize the ARPA-E-funded technologies. In order to ensure the commercialization of these technologies, ARPA-E negotiated an option in these two TIAs by which the small businesses could repay, with interest, ARPA-E's investment. Once the investment (with interest) was repaid, the government license and march-in rights would expire. In ARPA-E's view, if a company is willing to repay the initial government investment with interest, then that company has a concrete and demonstrable commitment to commercialize the technology in the United States.

One of the small businesses also requested a procedural modification to the U.S. Competitiveness clause, which requires the recipient (and its assignees and licensees) to manufacture subject inventions in the United States for any use or sale in the United States. All recipients are allowed to request a waiver of this requirement, but there is no established timeframe for ARPA-E/DOE to render a decision on such requests. ARPA-E/DOE agreed to render a decision within 90 days.

The third TIA recipient was concerned about protecting intellectual property that was developed at substantial private expense. The recipient was concerned that some of its intellectual property, though conceived before the ARPA-E award, would be "first actually reduced to practice" under its award, thus causing the technology to become a "subject invention" and the reserved government IP rights to apply to these technologies.

If not given the opportunity to negotiate government rights of a different scope, the recipient stated that it would not participate in the project. ARPA-E determined that the technology was unique and promised, if successful, a transformative advance in renewable energy.

After negotiation, ARPA-E/DOE agreed that the march-in rights, government license, and U.S. Competitiveness provisions would apply only to inventions conceived in the performance of the ARPA-E award that fell within the project scope, but not to inventions that were conceived prior to the ARPA-E award.

QUESTION FROM REPRESENTATIVE HALL

ARPA-E

Q12a. The preface of ARPA-E's FY 2012 budget request states: "The Advanced Research Projects Agency – Energy (ARPA-E) is devoted exclusively to funding specific high-risk, high payoff, game-changing research and development projects to meet the nation's long-term energy challenges."[1]

Does this imply that DOE's Office Science Basic Energy Sciences and applied technology programs are not "funding specific high-risk, high payoff, game-changing research and development projects to meet the nation's long-term energy challenges"?

A12a. As stated in the preface of the Office of Science, Basic Energy Sciences (BES) FY 2012 budget request: "The mission of the BES program is to support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels to provide the foundations for new energy technologies and to support DOE missions in energy, environment, and national security." BES funds *fundamental* basic scientific research that lays the foundation for advancements in energy technologies. BES plays a critical role within the Department of Energy because it is difficult to predict what scientific breakthroughs may lead to transformative energy technologies, but those breakthroughs when they occur have the potential to be significant. As such, it is therefore prudent to invest broadly in the fundamental science that underpins existing or potential energy technologies.

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[1] "ARPA-E's Fiscal Year 2012 Congressional Justification," p.2 (http://arpa-e.energy.gov/LinkClick.aspx?fileticket=otZens}luj1%3d&tabid=184. P.2)

QUESTION FROM REPRESENTATIVE HALL

ARPA-E

Q12b. The preface of ARPA-E's FY 2012 budget request states: "The Advanced Research Projects Agency – Energy (ARPA-E) is devoted exclusively to funding specific high-risk, high payoff, game-changing research and development projects to meet the nation's long-term energy challenges."

Please explain the differences between the types of projects ARPA-E funds and those funded by the Office Science Basic Energy Sciences and applied technology programs.

A12b. BES funds *fundamental* scientific research that lays the foundation for advancements in energy technologies. ARPA-E takes novel ideas, many of which emerge from fundamental research, and supports their rapid development toward commercially viable energy technologies. For BES, the prime metric is knowledge generation and BES projects that continue to be scientifically productive, as confirmed by rigorous merit review, can last for many years.

ARPA-E has a fundamentally different mission and function than other Department of Energy programs. As directed by its statute, ARPA-E has a unique focus within the Department of Energy on "long-term, high-risk programs to overcome long-term and high-risk technological barriers to the development of energy technologies." ARPA-E draws on the basic scientific research done by BES to identify transformational energy technologies that have high technical and market risks, and funds projects where short-term R&D effort could deliver game-changing results. ARPA-E does not fund proposals that are deemed to have low transformational value, meaning incremental improvements on existing technology. For example, an ARPA-E project is converting an aluminum manufacturing process into a liquid metal battery for grid-level electricity storage – this approach is too application-oriented for the Office of Science and perhaps too high risk for DOE's applied energy offices. This is the "white-space" in which ARPA-E operates.

QUESTION FROM REPRESENTATIVE HALL

Gas Prices

Q13a. According to historical records from the Energy Information Agency, the price of a gallon reached its highest price ever in the month of February.

The FY12 budget proposal increases taxes on oil and natural gas producers by roughly $3.6 billion. Do you agree that additional costs imposed on industry through higher taxes will further drive up gas prices and be passed through to consumers?

A13a. While there is no silver bullet to address rising gas prices in the short term, there are steps we can take to ensure the American people don't fall victim to skyrocketing gas prices over the long term. One of those steps is to eliminate unwarranted tax breaks to the oil and gas industry and invest that revenue into clean energy to reduce our dependence on foreign oil. Our outdated tax laws currently provide the oil and gas industry more than $4 billion per year in these subsidies, even though oil prices are high and the industry is projected to report outsized profits this quarter. In fact, in the past CEO's of the major oil companies made it clear that high oil prices provide more than enough profit motive to invest in domestic exploration and production without special tax breaks. As we work together to reduce our deficits, we simply can't afford these wasteful subsidies, and that is why the Administration proposed to eliminate them in the FY11 and FY12 budgets.

QUESTION FROM REPRESENTATIVE HALL

Gas Prices

Q13b. According to historical records from the Energy Information Agency, the price of a gallon reached its highest price ever in the month of February.

What will be the economic impact on the American people and the overall economy if gas prices continue to rise?

A13b. Rising prices at the pump affect everybody, which is why we need to make ourselves more secure and control our energy future by harnessing all of the resources that we have available and embracing a diverse energy portfolio. When President Obama took office, America imported 11 million barrels of oil a day. He has pledged that by a little more than a decade from now, we will have cut that by one-third, and put forward a plan to secure America's energy future by producing more oil at home and reducing our dependence on oil by leveraging cleaner, alternative fuels and greater efficiency. The Administration's *Blueprint for a Secure Energy Future* outlines the comprehensive national energy policy that this Administration has pursued since day one, and which we will build upon to secure our energy future. It includes a comprehensive program to develop and secure our energy supplies, provide consumers with choices to reduce costs and save energy, and to innovate new and cleaner energy technology.

While there is no silver bullet to address rising gas prices in the short term, there are steps we can take to ensure the American people don't fall victim to skyrocketing gas prices over the long term. One of those steps is to eliminate unwarranted tax breaks to the oil and gas industry and invest that revenue into clean energy to reduce our dependence on foreign oil. Our outdated tax laws currently provide the oil and gas industry more than

$4 billion per year in these subsidies, even though oil prices are high and the industry is projected to report outsized profits this quarter. In fact, in the past CEO's of the major oil companies made it clear that high oil prices provide more than enough profit motive to invest in domestic exploration and production without special tax breaks. As we work together to reduce our deficits, we simply can't afford these wasteful subsidies, and that is why the Administration proposed to eliminate them in the FY11 and FY12 budgets.

QUESTION FROM REPRESENTATIVE HALL

Gas Prices

Q13c. According to historical records from the Energy Information Agency, the price of a gallon reached its highest price ever in the month of February.

What specific actions are you taking to help alleviate these rising gas prices with respect to advancing domestic supply and production capabilities?

A13c. Rising prices at the pump affect everybody, which is why we need to make ourselves more secure and control our energy future by harnessing all of the resources that we have available and embracing a diverse energy portfolio. When President Obama took office, America imported 11 million barrels of oil a day. He has pledged that by a little more than a decade from now, we will have cut that by one-third, and put forward a plan to secure America's energy future by producing more oil at home and reducing our dependence on oil by leveraging cleaner, alternative fuels and greater efficiency. The Administration's *Blueprint for a Secure Energy Future* outlines the comprehensive national energy policy that this Administration has pursued since day one, and which we will build upon to secure our energy future. It includes a comprehensive program to develop and secure our energy supplies, provide consumers with choices to reduce costs and save energy, and to innovate new and cleaner energy technology.

America's public lands and Federal waters provide resources that are critical to the nation's energy security. To encourage robust exploration and development of the nation's resources, the Administration has offered millions of acres of public land and Federal waters for oil and gas leasing over the last two years. Oil production from the Outer Continental Shelf increased more than a third – from 446 million barrels in 2008 to more than 600 million barrels of estimated production in 2010. Responsible oil production from onshore public lands also increased over the past year -- from 109 million barrels in 2009 to 114 million barrels in 2010. These increases are occurring at the same time that oil imports are decreasing; for the first time in a decade, imports accounted for less than half of what we consumed.

QUESTION FROM REPRESENTATIVE HALL

Nuclear Energy R&D

Q14. As you know, the Blue Ribbon Commission recommendations do not carry the weight of law and will likely require Congress to amend the nuclear Waste Policy Act to implement the recommendations. Given your repeated reliance on the Commission to justify DOE's closure of Yucca Mountain, how does DOE plan to implement the recommendations in the absence of Congressional action?

A14. The Blue Ribbon Commission is set to deliver its interim report in July 2011, but will not finish its final report until January 2012. Some of the Commission's recommendations may not require Congressional action. For example, recommendations on used fuel disposition R&D could be incorporated into DOE research programs if deemed appropriate. Other recommendations could potentially require changes to the Nuclear Waste Policy Act, but DOE has no advance knowledge of what the Commission will recommend. The Administration will carefully consider all of the recommendations of the Commission.

QUESTION FROM REPRESENTATIVE HALL

Nuclear Energy R&D

Q15. The DOE FY12 budget request significantly cuts the NGNP project budget. The Energy Policy Act of 2005 sets a target date for completion of the project as September 30, 2021. Is that date still possible under the current and requested Department budgets?

A15. The FY 2012 request for the NGNP project maintains essential research and development (R&D) activities. A Secretarial decision on the future of this project is planned for the fourth quarter of FY 2011. Future funding needs and schedules for R&D, design, licensing and construction will be determined through standard planning and budget development processes and will be outlined in future Budget requests.

QUESTION FROM REPRESENTATIVE HALL

Nuclear Energy R&D

Q16. What is DOE's current plan for an NGNP public/private partnership? What is the status of that plan?

A16. The Department of Energy has completed a market research survey that asked respondents for feedback on a number of aspects of the terms and conditions of various potential federal contracting mechanisms. The results of this survey are being factored into a draft solicitation for forming a cost-shared public-private partnership for the design, licensing and construction of the Next Generation Nuclear Plant (NGNP) Demonstration Project. As stated in the Budget, a Secretarial decision on the future of the NGNP project is planned for the fourth quarter of FY 2011 and will consider technical, financial performance, and other issues in determining the appropriate next steps, including whether to proceed further on the project. FY 2012 funding will be used to continue ongoing important fuels, materials and thermohydraulic modeling research and development. Future funding needs will be determined through standard planning and budget development processes and will be outlined in future Budget requests.

For integrated gasification combined cycle (IGCC) plants equipped with CCS, the COE increases by 35 percent compared to current IGCC plants without CCS. DOE R&D is focused on developing new technologies that achieve 90 percent CO_2 capture at no more than a 10 percent increase in LCOE.

QUESTION FROM REPRESENTATIVE HALL

Increased Electricity Costs from Carbon Capture and Sequestration

Q17. As the President noted in his State of the Union, his 80 percent clean energy goal would require deployment of clean coal technology – more precisely, carbon capture and sequestration (CCS) systems on coal-fired power plants. According to the Department of Energy's recently released CCS Roadmap, the Administration's goal is to reduce CCS energy usage to be 30 percent higher than conventional coal-fired power plants. [http://www.netl.doe.gov/technologies/carbon_seq/refshelf/CCSRoadmap.pdf]

What is the expected cost premium for electricity produced by a CCS plant compared to traditional coal-fired power plants?

A17. While the Administration's CES proposal would enable coal with CCS to count as a clean energy source, it would not require the deployment of CCS or any other specific clean energy technology. Rather, the CES is a flexible approach that taps American ingenuity and innovation. The CES sets a target for the share of electricity from clean energy sources, while allowing businesses and entrepreneurs to figure out the best way to meet it.

One of the Department of Energy's goals is to drive innovation in clean coal technologies in order to use this resource more cleanly while minimizing additional costs. For supercritical pulverized coal (SCPC) plants equipped with carbon capture and sequestration (CCS), the levelized cost of electricity (COEL) will increase between 60 percent and 80 percent compared to current SCPC plants without CCS. DOE research and development (R&D) is focused on developing new post-combustion and oxy-combustion technologies that achieve 90 percent CO_2 capture at no more than a 35 percent increase in LCOE.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q18a. The recently released *Economic Report of the President (ERP)* states that "the Administration is proposing a Clean Energy Standard (CES) that would require electric utilities to obtain an increasing share of delivered electricity from clean sources—starting at the current level of 40 percent and doubling over the next 25 years," where "clean energy sources" are "defined broadly to include renewables and nuclear power as well as partial credit for fossil fuels with carbon capture and sequestration [CCS] and efficient natural gas."

What is the "partial credit for fossil fuels with carbon capture and sequestration and efficient natural gas" – 75 percent, 50 percent, some other percentage?

A18a. The Administration has put forward a broad framework that sets out a number of principles for the design of a CES. These include awarding partial credit for efficient natural gas generation, without specifying that credit precisely. The Administration is committed to working with Congress on such details as legislation is developed.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q18b. The recently released *Economic Report of the President (ERP)* states that "the Administration is proposing a Clean Energy Standard (CES) that would require electric utilities to obtain an increasing share of delivered electricity from clean sources—starting at the current level of 40 percent and doubling over the next 25 years," where "clean energy sources" are "defined broadly to include renewables and nuclear power as well as partial credit for fossil fuels with carbon capture and sequestration [CCS] and efficient natural gas."

What is the basis for such a "partial credit"?

A18b. The Administration has put forward a broad framework for the design of a CES that proposes partial crediting for efficient natural gas, as well as fossil fuel plants with CCS, but does not specify a level of partial crediting for either technology. In general, partial crediting is a means of accounting for differences in the emissions produced by various categories of technologies and fuels for electricity generation. The Administration is committed to working with Congress on details such as crediting under a Clean Energy Standard as legislation is developed.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q19a. The recently released Energy Information Administration (EIA) *Annual Energy Outlook 2011* projects that U.S. net electricity generation in 2035 will be about 69 percent fossil (43 percent coal, 25 percent natural gas, and 1 percent petroleum), 17 percent nuclear and 14 percent renewable—only a modest change from the 2009 percentages, and far from the President's 80 percent goal.

So the DOE energy industry experts are predicting that we will still be heavily reliant on fossil fuels for electricity in 2035. How would this projection change if the President's Clean Energy Standard were adopted? In other words, what is the Administration's 2035 projection of the U.S. net electricity generation mix? How much nuclear? How much renewable? How much fossil fuels with CCS?

A19a. The Administration has not endorsed a preferred technology mix in 2035, and the CES would not dictate any particular outcome. The proposed CES sets a target for the share of electricity from clean energy in 2035, and then allows businesses and entrepreneurs to figure out the best way to meet it. Since clean energy is defined very broadly to include renewables, nuclear power, efficient natural gas, and coal or natural gas with carbon capture and storage, a very large number of possible technology mixes are possible. This is a flexible approach that taps American ingenuity and innovation – and channels it toward a clean energy future.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q19b. The recently released Energy Information Administration (EIA) *Annual Energy Outlook 2011* projects that U.S. net electricity generation in 2035 will be about 69 percent fossil (43 percent coal, 25 percent natural gas, and 1 percent petroleum), 17 percent nuclear and 14 percent renewable—only a modest change from the 2009 percentages, and far from the President's 80 percent goal.

Has the Administration costed this out, and if not, why not? If so, what is this going to cost from now to 2035—over and above the EIA Reference Case Scenario—and what will be the increase in electricity prices?

A19b. The Administration has put forward an ambitious but achievable goal of producing 80% of our electricity from clean sources by 2035 through a Clean Energy Standard (CES). The framework put forward by the Administration includes broad principles, but many details remain to be filled in as the legislative process move forward. As a result, there is not a cost estimate of the Administration's CES proposal at this time. Generally, changes in future electricity prices will depend on a variety of factors, some related to policy design and some related to other factors, like consumption and natural gas supply. The inherent flexibility of the CES proposal helps to minimize the cost of meeting the targets. In addition, the President has indicated that this policy should be paired with complementary energy efficiency provisions to lower consumer bills even further.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q20a. The recently released *Economic Report of the President (ERP)* also states that under the Administration's proposed Federal Clean Energy Standard, "Electricity generators would receive credits for each megawatt-hour of clean energy generated; utilities with more credits than needed to meet the standard could sell the credits to other utilities or bank them for future use."

Under the Administration's proposed Federal Clean Energy Standard, wouldn't the Federal Government essentially set a cap on the amount of fossil fuel energy that can be used to generate electricity?

A20a. No. The Clean Energy Standard does not set a cap on the amount of fossil fuels that can be used to generate electricity. Rather, the CES defines clean energy broadly to include efficient natural gas, and coal with carbon capture and sequestration. These fuels and technologies will compete on a level playing field with other forms of clean energy, like wind and solar. The CES is a flexible approach that taps American ingenuity and innovation. The CES sets an annual target for the share of electricity from clean energy sources, while allowing businesses and entrepreneurs to figure out the best way to meet it.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q20b. The recently released *Economic Report of the President (ERP)* also states that under the Administration's proposed Federal Clean Energy Standard, "Electricity generators would receive credits for each megawatt-hour of clean energy generated; utilities with more credits than needed to meet the standard could sell the credits to other utilities or bank them for future use."

Is it correct to say that if utilities that use lots of coal, such as those in the Southeastern U.S. or Midwest, then those utilities would have to buy clean energy credits to meet the cap?

A20b. As noted in the previous answer, the Clean Energy Standard would not impose a "cap" of any kind. Nor would any utility have to buy clean energy credits to meet the standard. Any utility would be free to meet its target by adjusting its own generation portfolio. For example, coal-fired units could be equipped with carbon capture and storage technology to generate clean energy credits. As noted above, the CES does not require utilities to deploy any particular technologies or to follow any particular strategy for compliance. Rather, it sets a target for the share of electricity from clean energy sources, while allowing businesses and entrepreneurs to figure out the best way to meet it.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q20c. The recently released *Economic Report of the President (ERP)* also states that under the Administration's proposed Federal Clean Energy Standard, "Electricity generators would receive credits for each megawatt-hour of clean energy generated; utilities with more credits than needed to meet the standard could sell the credits to other utilities or bank them for future use."

Is it correct to say that such utilities would have to buy clean energy credits to meet the cap and would pass the costs of these credits to their consumers, thereby raising their electricity rates?

A20c. As noted in the previous answer, the Clean Energy Standard would not impose a "cap" of any kind. Nor would any utility have to buy clean energy credits to meet the standard. Any utility would be free to meet its target by adjusting its own generation portfolio. In addition, if the utility generated excess credits in early years, it could hold those credits for use in later years. These are examples of flexibility mechanisms being considered that complement -- and generally reduce the need for -- credit exchange between utilities.

QUESTION FROM REPRESENTATIVE HALL

Clean Energy Standard

Q20d. The recently released *Economic Report of the President (ERP)* also states that under the Administration's proposed Federal Clean Energy Standard, "Electricity generators would receive credits for each megawatt-hour of clean energy generated; utilities with more credits than needed to meet the standard could sell the credits to other utilities or bank them for future use."

And by steadily ratcheting up the clean energy standard, wouldn't the Government be tightening the cap on fossil fuel energy, steadily raising the prices of clean energy credits, which would also be passed on to the customers of fossil fuel-dependent utilities—and steadily raise their electricity bills?

A20d. The Clean Energy Standard does not set a cap on the amount of fossil fuels that can be used to generate electricity. Rather, the CES defines clean energy broadly to include efficient natural gas, and coal or natural gas with carbon capture and sequestration, along with renewables and nuclear power. The CES sets a target for the share of electricity from these clean energy sources, while allowing businesses and entrepreneurs to figure out the best way to meet it. This is a flexible approach that taps American ingenuity and innovation.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q21a. The Nuclear Energy Loan Guarantee program—authorized in EPACT 2005—has only supported construction of one new plant. Constellation Energy recently chose to back out of a loan guarantee due to unfavorable financial terms pushed by the Administration.

Given the importance of nuclear energy to meeting future energy demand, what are you doing to ensure future projects don't meet the same fate as earlier proposals?

A21a. First of all, as you mention, the Loan Guarantee Program was created in 2005 and funded in 2008, yet had not issued a single loan until this Administration. Under the leadership of President Obama and Secretary Chu, the Loan Guarantee Program has committed nearly $28 billion in total government supported financing, including capitalized interest to support more than 25 clean energy projects, including construction of the first new American nuclear reactors in more than three decades, a front-end uranium enrichment project, and solar, geothermal, and wind projects from Oregon to Maine.

DOE remains committed to supporting transformative and safe nuclear power projects through Title XVII loan guarantees, and we continue to work diligently on all projects currently active in our pipeline, including the one referenced in your question.

DOE is required by statute to ensure that the loan guarantees it provides have a "reasonable prospect of repayment." We take this obligation seriously, and the financial terms we require of our borrowers are designed to ensure that taxpayer funds are appropriately protected.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q21b. The Nuclear Energy Loan Guarantee program—authorized in EPACT 2005—has only supported construction of one new plant. Constellation Energy recently chose to back out of a loan guarantee due to unfavorable financial terms pushed by the Administration.

Please describe in detail DOE's input into the development of the credit subsidy cost. What changes to OMB's formula for the credit subsidy would you suggest?

A21b. For each transaction, DOE estimates the credit subsidy cost, and OMB must review and approve such estimates. DOE's estimate is developed using a complex model approved by OMB in 2008. While the model has many inputs, two of the principal inputs are DOE's assessment of the project's risk of default and potential recoveries in the event of default. These estimates reflect all available information related to the project, including, where appropriate, technical, legal, and market analyses by independent entities.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q21c. The Nuclear Energy Loan Guarantee program—authorized in EPACT 2005—has only supported construction of one new plant. Constellation Energy recently chose to back out of a loan guarantee due to unfavorable financial terms pushed by the Administration.

Please provide the model, methodology, and underlying assumptions which determine the financial terms for all loan guarantees awarded under both Sections 1703 and 1705 programs.

A21c. LPO's underwriting process is based on the best practices of other U.S. government programs, and is similar to – and in some cases more comprehensive than – the underwriting that a private sector lender would do for similar projects. The terms of our loan guarantees depend on the specifics of the various projects – each of which is unique. There is no one approach or set of assumptions that determine the terms for all of our loan guarantees – which encompass an array of technologies, project types, and financial structures.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q22. What is the status of the Executive Branch initiated interagency review of the methodology and assumptions used by DOE and OMB to calculate credit subsidy costs? When can we expect to hear the outcome?

A22. The Administration is committed to ensuring that the credit subsidy model and methodology result in credit subsidy calculations that are as accurate as possible, and reflective of all relevant and available information. We continue to work with OMB to ensure accurate credit subsidy cost estimates.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q23. Please provide the information requested in the following tables for all projects that have received loan guarantees to date under the Advanced Technology Vehicles Manufacturing (ATVM) Loan and the Title 17 Innovative Technology Loan Guarantee Programs.

Also, please provide justification of each of the annual fuel savings estimates for the projects under the ATVM Loan Program and the permanent/construction job estimates for the projects under both ATVM and Title 17 Loan Programs.

A23. Job estimates for the Title XVII and ATVM programs are based on estimates provided by the applicants. In place of annual fuel savings, the ATVM Loan Program calculates annual petroleum displaced. The annual petroleum displaced is based on:

1. Annual average vehicle miles driven of 12,000 miles
2. The difference of a 2005 vehicle fuel economy baseline (legislation required this baseline) and the 3-year average fuel economy of the vehicles that will be produced between the years 2011 – 2014 from the ATVM program in miles per gallon.
3. The planned annual production of those vehicles.
4. Then the calculation is:

$$\text{Annual Petroleum Displaced} = \left(\frac{12{,}000}{\text{Baseline Fuel Economy (mpg)}} * \text{Production Volume} \right) - \left(\frac{12{,}000}{\text{ATV Fuel Economy (mpg)}} * \text{Production Volume} \right)$$

Advanced Technology Vehicles Manufacturing Loan Program

Project	Loan Amount ($m)*	Perm Jobs Created or Saved**	Status	CC/ Closing Date	Project Description	Annual Avoided CO2 (tons)	Annual Petroleum Displaced (Gallons)
Fisker Automotive	$529	2,000	Closed	4/22/10	OEM	154,218	17,400,000
Ford Motor Company	$5,907	33,000	Closed	9/16/09	OEM	2,018,134	227,700,000
Nissan North America, Inc.	$1,448	1,300	Closed	1/28/10	OEM	203,852	23,000,000
Tesla Motors	$465	1,500	Closed	1/20/10	OEM	25,703	2,900,000
VPG	$50	900	Closed	3/11/11	OEM	8,960	10,600,000

* Loan amounts have been rounded.

** Job numbers provided by the applicants.

Title 17 Innovative Technology Loan Guarantee Program

Project	LG Amount ($m)*	Jobs (Const/ Perm)**	Status	CC/ Closing Date	Location	Technology	Annual Avoided CO2 (tons)
Solyndra Inc.	$535	3,000/ 1,000	Closed	9/4/09	Fremont, CA	Solar Mfg.	391,097
Beacon Power Corporation	$43	20/14	Closed	8/9/10	Tyngsboro, MA Stephentown, NY	Energy Storage	N/A
Nordic Windpower USA, Inc.	$16	0/75	Conditional Commitment	7/2/09	Berkeley, CA Pocatello, ID	Wind Mfg.	188,743
Red River Environmental Products, LLC	$245	500/70	Conditional Commitment	12/8/09	Littleton, CO Coushatta, LA	Energy Efficiency	62,627
Georgia Power	$8,330	4.375/800	Conditional Commitment	2/16/10	Atlanta, GA Atlanta, GA Tucker, GA Waynesboro, GA	Nuclear Gen.	10,316,521
BrightSource Energy, Inc.	$1,600	1,000/86	Closed	4/11/11	Oakland, CA Baker, CA	Solar Gen.	573,501
Kahuku Wind Power, LLC. (First Wind)	$117	200/10	Closed	7/27/10	Boston, MA Kahuku, Oahu, HI	Wind Gen.	40,794
SAGE Electrochromics, Inc.	$72	210/160	Conditional Commitment	3/5/10	Faribault, MN	Energy Efficiency	129,850
Areva	$2,000	1,000/310	Conditional Commitment	5/20/10	Idaho Falls, ID	Front-end Nuclear	N/A
US Geothermal, Inc.	$97	150/10	Closed	2/24/11	Boise, ID Malheur County, OR	Geothermal	103,421
Nevada Geothermal Power Company, Inc. (Blue Mountain)	$79	200/14	Closed	9/7/10	Humbolt County, NV	Geothermal	175,240
Abound Solar	$400	2,500/1,500	Closed	12/14/10	Longmont, CO Tipton, IN	Solar Mfg.	1,095,070
Abengoa Solar, Inc.	$1,446	1,600/80	Closed	7/3/10	Gila Bend, AZ	Solar Gen.	543,949
AES Corporation	$17	30/5	Closed	8/2/10	Johnson City, NY	Battery Storage	N/A
Caithness Shepherds Flat	$1,040	400/35	Closed	10/8/10	Gilliam and Morrow Counties, OR	Wind Generation	1,032,483
LS Power Associates (ON Line) (SWIP)	$343	400/15	Closed	2/11/11	Ely to Las Vegas, NV	Transmission	N/A
Agua Caliente	$967	400/10	Conditional Commitment	1/20/11	Yuma County, AZ	Solar Gen.	372,314

Project	LG Amount ($m)*	Jobs (Const/ Perm)**	Status	CC/ Closing Date	Location	Technology	Annual Avoided CO2 (tons)
SoloPower, Inc.	$197	250/450	Conditional Commitment	2/18/11	Wilsonville, OR	Solar Mfg.	456,279
Record Hill Wind	$102	200/8	Conditional Commitment	3/3/11	Roxbury, ME	Wind Gen.	55,273
California Valley Solar Ranch	$1,305	350	Conditional Commitment	4/12/11	California Valley, CA	Solar Gen.	390,700
Solar Millenium Blythe	$2,105	1,500/80	Conditional Commitment	4/18/11	Blythe, CA	Solar Gen.	633,164
Cogentrix Alamosa Solar	$90	75/9	Conditional Commitment	5/10/11	Alamosa , CO	Solar Gen.	43,092
Solar Reserve Tonopah	$734	600/45	Conditional Commitment	5/19/11	Nye County, NV	Solar Gen.	289,348
Fotowaito	$45	66/9	Conditional Commitment	6/2/11	NE Las Vegas, NV	Solar Gen.	31,601
Ormat (Nevada)	$280	332/64	Conditional Commitment	6/9/11	Jersey Valley, McGinness Hills, and Tuscarora, NV	Geothermal	578,559
Abengoa Mojave	$1,320	830/61	Conditional Commitment	6/14/11	San Bernardino County, CA	Solar Gen.	354,640
Genesis	$702	800/47	Conditional Commitment	6/14/11	Eastern Riverside County, CA,	Solar Gen.	321,753
Sempra Mesquite	$398	300/7	Conditional Commitment	6/15/11	Maricopa County, AZ	Solar Gen.	200,826
Calisolar	$275	1,000/ 1,100	Conditional Commitment	6/16/11	Ontario, OH	Solar Mfg.	N/A
1366 Technologies, Inc	$150	50/70	Conditional Commitment	6/17/11	Lexington, MA	Solar Mfg.	N/A

* Loan Guarantee amounts have been rounded.
** Job numbers provided by the applicants.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q24. Which projects identified in question 23 above committed to secure U.S.-manufactured project components? Which will secure components from foreign sources?

A24. In reviewing applications for loans and loan guarantees, the DOE considers the percentage of project components that are sourced domestically. The project-specific information you have requested may be protected by the Trade Secrets Act, which prevents us from sharing it in our response.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q25. Please provide justification of each of the annual fuel savings/avoided CO_2 estimates for the projects identified in question 23 above.

A25. See response A23 for the annual fuel savings calculation for ATVM projects.

For power generation facilities, the calculations for CO2 avoided estimates are derived from each project's annual generation output in megawatt hours (provided by the applicant), using conversion factors for average annual household energy usage and CO2 emissions published by the Energy Information Administration and the EPA.

For vehicle and fuel production projects, CO2 estimates are derived from the project's projected annual petroleum displaced in gallons using conversion factors published by EIA.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q26. Please provide justification of each of the permanent/construction job estimates for the projects identified in Q1 above under both ATVM and Title 17 Loan Programs. How many domestic jobs and how many non-U.S. jobs?

A26. Job numbers for both ATVM and Title XVII loan programs are based on estimates provided by the sponsored companies. According to 74 FR 14824, only compensated employment in the U.S. or outlying areas should be counted.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q27. A justification for loan guarantees is that they lower the cost of capital for companies so they can develop projects that would otherwise not be financially feasible. For each of the projects identified in Q1 above, how much was the cost of capital lowered by the DOE loan guarantee?

A27. DOE has not conducted this type of analysis. Given how project-specific the cost of capital and options and terms for private financing can be, such an analysis could be difficult to perform and would be sensitive to a number of uncertain project-specific assumptions about the availability of private sector capital. Further, DOE believes that capital costs represent sensitive corporate information that may be protected by the Trade Secrets Act.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q28a. An October 25, 2010 "Memorandum for the President" from Carol Browner, Ron Klain, and Larry Summers sought the President's "direction on implementing the energy loan guarantee program."

The Memorandum states: "Project sponsor for all power generation projects under the 1705 program have indicated they intend to claim a 1603 grant once they enter service... The combined effect of 1603 and 1705 lowers the cost of a new wind farm by about 55% and solar technologies by about half relative to a no-subsidy case (see appendix table 1 [below]). Renewables' intermittency problem limits the deployment of these technologies, which could be remedied by installing back-up capacity (likely increases the cost by 2 to 40¢/kWh). Past experience with the wind tax credit suggests that the 1603 grant and the associated tax credits could have a significant impact on new wind capacity."

Appendix Table 1: Cost of Generating Power from New Capacity Investment by Technology Type, ¢/kWh

	Natural Gas	Wind	Solar
No Subsidy Cost	7.3	8.8	23.2
Cost with 1603	7.3	6.7	16.0
Cost with 1603 and 1705	7.3	4.0	12.6

Source: DOE Energy Information Administration 2010.

Do you agree with this analysis, and if not, why not?

A28a. The Administration regularly engages in discussions on an array of issues, including those discussed in the memorandum.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q28b. An October 25, 2010 "Memorandum for the President" from Carol Browner, Ron Klain, and Larry Summers sought the President's "direction on implementing the energy loan guarantee program."

The Memorandum also states: "OMB and Treasury, which have statutory obligations to review 1705 loan guarantees, have raised implementation questions, including: "double dipping"—the total government subsidy for loan guarantee recipients, which have exceeded 60%; "skin in the game"—the relatively small private equity (as low as 10%) developers put into projects; and non-incremental investment – some loan guarantee projects would appear likely to move forward without the credit support offered by 1705 (including those projects that already exist and for which the loan guarantee simply provides a means for refinancing)."

Do you agree there has been "double-dipping," that the total government subsidy for loan guarantee recipients has exceeded 60%, and that developers have put relatively small private equity (as low as 10%) into projects? If not, why not?

A28b. The Administration regularly engages in discussions on an array of issues, including those discussed in the memorandum. We note that there is nothing in the Recovery Act or Title XVII of EPAct 2005 that restricts the issuance of loan guarantees for projects that may also receive other Federal tax benefits. The 2009 Omnibus Appropriations Act does include a restriction on the use of authority provided by that act for Section 1703 projects that rely on certain other forms of Federal support. Notably, "otherwise allowable Federal income tax benefits" are expressly excluded from that restriction.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q28c. An October 25, 2010 "Memorandum for the President" from Carol Browner, Ron Klain, and Larry Summers sought the President's "direction on implementing the energy loan guarantee program."

The Appendix to the Memorandum provides an analysis of the Caithness Shepherds Flat loan guarantee project, an 845-megawatt wind generation facility located in eastern Oregon sponsored by Caithness Energy, LLC and GE Energy Financial Services as follows:

Appendix: Shepherds Flat Loan Guarantee

The Shepherds Flat loan guarantee illustrates some of the economic and public policy issues raised by OMB and Treasury. Shepherds Flat is an 845-megawatt wind farm proposed for Oregon. This $1.9 billion project would consist of 338 GE wind turbines manufactured in South Carolina and Florida and, upon completion; it would represent the largest wind farm in the country. The sponsor's equity is about 11% of the project costs, and would generate an estimated return on equity of 30%.

- Double dipping: The total Government subsidies are about $1.2 billion.

Subsidy Type	Approximate Amount (millions)
Federal 1603 grant (equal to 30% investment tax credit)	$500
State tax credits	$18
Accelerated depreciated on Federal and State taxes	$200
Value of loan guarantee	$300
Premium paid for power from state renewable electricity standard	$220

- Skin in the game: The government would provide a significant subsidy ($65+%), while the sponsor would provide little skin in the game (equity about 10%).
- Non-incremental investment: This project would likely move without the loan guarantee. The economics are favorable for wind investment given tax credits and state renewable energy standards, GE signaled through Hill staff that it considered going to the private market for financing out of frustration with the review process. The return on equity is high (30%) because of tax credits, grants, and selling power at above-market rates, which suggests that the alternative of private financing would not make the project financially non-viable.
- Carbon reduction benefits: If this wind power displaced power generated from sources with the average California carbon intensity, it would result in about 18 million fewer

tons of CO2 emissions through 2033. Carbon reductions would have to be valued at nearly $130 per ton Co2 for the climate benefits to equal the subsidies (more than 6 times the primary estimate used by the government in evaluating rules).

Do you agree with this analysis, and if not, why not?

A28c. The Administration regularly engages in discussions on an array of issues, including those discussed in the memorandum. At the time GE Energy Financial Services and Caithness Energy applied for a loan guarantee, the debt markets were shallow and high-priced due to the financial market meltdown. Moreover, this project – the world's largest wind farm – required significantly more debt financing than the more conventional projects. The DOE loan guarantee program was able to offer the project financing of the necessary size and tenor.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q28d. An October 25, 2010 "Memorandum for the President" from Carol Browner, Ron Klain, and Larry Summers sought the President's "direction on implementing the energy loan guarantee program."

In spite of the concerns expressed in the memorandum about the Caithness Shepherds Flat loan guarantee project, on December 16, 2010, Secretary of Energy Chu announced that "a partial loan guarantee for a $1.3 billion loan [had] been finalized to support the world's largest wind farm." What was the justification for proceeding?

A28d. The Administration regularly engages in discussions on an array of issues, including those discussed in the memorandum. The Shepherds Flat project was eligible for the 1705 loan program and the proposed loan guarantee in question was consistent with all applicable rules and regulations governing the DOE loan programs, including that it demonstrated a reasonable prospect of repayment.

QUESTION FROM REPRESENTATIVE HALL

Loan Guarantees

Q28e. An October 25, 2010 "Memorandum for the President" from Carol Browner, Ron Klain, and Larry Summers sought the President's "direction on implementing the energy loan guarantee program."

For each of the projects identified in Q1 above, please provide the total amount of government (federal and state) subsidies and the amount of private equity from project developers.

A28e. The Administration regularly engages in discussions on an array of issues, including those discussed in the memorandum. The requested information may be protected by the Trade Secrets Act, which prevents us from sharing it in this response.

QUESTION FROM REPRESENTATIVE HALL

Better Building Initiative

Q29. The request includes $105 million to support the creation of a pilot loan guarantee program for energy efficiency retrofits for universities, schools, and hospitals.

What details can you provide on this proposal? For example, would public institutions receive more favorable treatment than private institutions? How would you calculate the credit subsidy, default risk and terms of repayment from another government entity?

A29. The purpose of this program is to spur investment in energy efficiency retrofits for buildings which serve as assets to our communities. As a pilot program, the Department requests $100 million for loan guarantee subsidy costs to support up to $2 billion in loan guarantees for universities, schools, and hospitals. The remainder of the request is intended for the administrative costs to carry out the program. While the details of this program are being worked out, the budgetary effects will be calculated consistent with the requirements of the Federal Credit Reform Act and implementing guidance.

QUESTION FROM REPRESENTATIVE HALL

Better Building Initiative

Q30a. There are multiple initiatives requesting significant funding to pass along to localities, such as a "Race to the Green" competitive grant program and $229 million for distribution to municipalities for infrastructure upgrades to deploy electric vehicles.

What safeguards exist to ensure the cities would responsibly spend the money?

A30a. The President's Budget for FY 2012 includes $200 million within the EERE Vehicle Technologies Program for competitive grants to help communities across the country become early adopters of electric vehicles (EVs) through regulatory streamlining, infrastructure investments, vehicle fleet conversions, deployment of EV incentives (e.g., parking, HOV access), partnerships with major employers/retailers, and improving workforce training and certification standards. The President's Budget also provides funding within the EERE Buildings Technology Program for the Race to the Green competitive grant program.

As these grant programs are contingent on receiving FY12 funding, detailed solicitations have not yet been developed. However, all federal financial assistance agreements require monitoring in accordance with DOE's monitoring guidelines, which incorporate requirements for quarterly reporting, monitoring-focused site visits, adherence to funding requirements for the use of money on eligible expenses, and in some cases, annual financial audits. An award recipient would be assigned a DOE project officer who has been delegated responsibility for ensuring the proper use of funds and adherence to all relevant rules and regulations throughout the award period.

QUESTION FROM REPRESENTATIVE HALL

Better Building Initiative

Q30b. There are multiple initiatives requesting significant funding to pass along to localities, such as a "Race to the Green" competitive grant program and $229 million for distribution to municipalities for infrastructure upgrades to deploy electric vehicles.

What criteria will be used to determine grants and awards?

A30b. The President's Budget for FY 2012 includes $200 million within the EERE Vehicle Technologies Program for competitive grants to help communities across the country become early adopters of electric vehicles (EVs) through regulatory streamlining, infrastructure investments, vehicle fleet conversions, deployment of EV incentives (e.g., parking, HOV access), partnerships with major employers/retailers, and improving workforce training and certification standards. The President's Budget also provides funding within the EERE Buildings Technology Program for the Race to the Green competitive grant program.

As these grant programs are contingent on receiving FY12 funding, a detailed solicitation has not yet been developed. However, through a competitive merit-review process, Race to the Green funding would be provided to state and local governments to implement innovative approaches (to building codes, regulations and performance standards) to improving the energy efficiency of commercial buildings in their jurisdiction. Consistent with the President's goal to reduce energy use in buildings by 20% by 2020, this would include implementing best policy practices in encouraging energy efficiency in the commercial sector. Similarly, funding under the expanded grant program within the Vehicles Technologies Program would be provided, following a competitive merit-review process, to assist communities in becoming early adopters of electric drive vehicles, in support of the President's goal to put 1 million electric vehicles on the road.

QUESTION FROM REPRESENTATIVE HALL

Better Building Initiative

Q30c. There are multiple initiatives requesting significant funding to pass along to localities, such as a "Race to the Green" competitive grant program and $229 million for distribution to municipalities for infrastructure upgrades to deploy electric vehicles.

The FY 12 budget request provides only high level broad descriptions for the request of an additional $204 million for vehicle technologies deployment and the $181 million increase in commercial buildings integration for the "Race to the Green" initiative. Please provide to the Committee all details, planning documents and program materials that would help us further understand these proposals.

A30c. The Department of Energy is beginning a competitive program to help communities across the country become early adopters of electric vehicles (EVs) through regulatory streamlining, infrastructure investments, vehicle fleet conversions, deployment of EV incentives (e.g., parking, HOV access), partnerships with major employers/retailers, and improving workforce training and certification standards. The FY 2012 Budget will expand this initiative through a total of $200 million to provide competitive grants to communities across the country on the basis of their ability to demonstrate concrete reforms and use the funds to help catalyze electric vehicle deployment. The goal would be for funds to also serve as an incentive for communities to work together to simplify and streamline permitting processes and codes & standards that can take years to navigate for EV projects.

As a near-term pilot for this effort, the Department recently released a $5 million funding opportunity to help communities develop plans and strategies for EV and PHEV deployment, update their permitting processes, develop incentive programs, or launch other local or regional initiatives that can accelerate market acceptance. The pilot effort does not, however, include funds for electric vehicle charging infrastructure deployment.

The expansion of this program is contingent on receiving FY12 funding, and a detailed solicitation has not yet been developed. It is anticipated, however, that funds could be used for a variety of purposes depending on the needs of different communities. Communities' distinct plans would be expected to target activities that would maximize EV placement. Examples could include:

- Development of a strategic infrastructure placement plan that assesses the best locations for public charging based on where people live, work, shop and recreate;
- Installation of equipment for charging points to support residential, fleet and public recharging;
- Development of local policies that incentivize EV adoption such as HOV lane access;
- Improvement of workforce training and certification standards, such as for inspectors or for technicians who install and maintain electric vehicle related equipment;
- Streamlining of local permitting processes to more efficiently handle new electric vehicle infrastructure installations;
- Developing codes and standards relevant to electric vehicle recharging; and
- Community outreach and education and community-based incentives.

The initiative would seek community based partnerships that can serve as EV pacesetters for other communities to emulate. Lessons learned, EV implementation strategies, model permitting procedures, innovative incentives, and improving training and certification standards can be shared with other communities to leverage/jump-start similar efforts in multiple locales.

The Department is also proposing to fund the following activities with the $185 M increase in the FY12 budget for commercial buildings integration. Because these programs are contingent on receiving FY12 funding, detailed solicitations have not yet been developed for any of them.

- Race to the Green program ($100 M): Under this program, the Department proposes to competitively award approximately 10-20 grants to state and local governments for the purpose of implementing innovative approaches to energy efficiency in commercial buildings, including attracting private investment for such projects, in their jurisdictions. Much of the authority to alter codes, regulations, and performance standards relating to commercial energy efficiency lies in the jurisdiction of states and localities. These grants would help states and local governments catalyze activities to streamline standards, encourage upgrades, and attract private sector investment. These approaches may include (but are not limited to):

    - Streamlining the permitting process and other regulatory barriers;

  - Updating and harmonizing building energy codes;
  - Implementing building energy disclosure policies;
  - Standardizing actuarial data collection on building performance;
  - Providing limited loan loss reserve funds; and
  - Bundling existing utility rebates with private financing to enhance leverage.

  DOE would expect that applicants would need to demonstrate the amount of private sector financing that would be leveraged under the program, with a recommended target for at least 10:1 leverage based on DOE's experience with state and local grant programs.

- Better Buildings Challenge ($60 M): The Better Buildings Challenge is a program to drive innovation in the design and implementation of cost-effective buildings and integrated building systems with improved energy efficiency. Under this program, DOE will challenge industry to design cost-effective integrated building systems, including sensors, software, and inexpensive meters, to identify and diagnose energy waste and improve efficiency for building owners and managers. DOE funds would help provide technical and analytical support, best practices, guides, and technology options to assist in achieving the commitments made by building owner and developers. As a result of this work, DOE would develop and disseminate business models for buildings that have successfully implemented cost-effective whole-building or system energy efficiency improvements, using an integrated systems approach.

- Building Construction Technology Extension Partnership ($25 M): The Building Technologies Program proposes to pilot this small scale commercial building extension program with the National Institute Standards and Technology (NIST) and selected universities across the United States. A network of commercial building extension centers (i.e., relationships with universities and non-profits) would be established in partnership with industry, trade, and professional organizations. The extension centers would provide direct assistance to business to help them reduce their energy consumption, educate and train university students in energy efficiency auditing, operation, and implementation, and provide a network of partners with access to the best available practices, technologies, experience, and resources to conduct energy efficiency retrofits. Using this approach, regional extension centers would be better able to address issues important to their local construction and retrofit market. It is expected that these funds would be leveraged 2:1 from local businesses, existing state programs, and utilities.

QUESTION FROM REPRESENTATIVE HALL

European Lessons on Energy Subsidies

Q31. President Obama often references the energy subsidies pursued in Europe – particularly Germany and Spain – as a model that he would like the U.S. to follow. However, countries all across Europe – Germany, Spain, France, the Netherlands, and the U.K. – are in the process of dramatically scaling back their support for expensive renewable energy such as wind and solar and as a result, the markets for these technologies have collapsed – especially solar energy. Why is the European subsidy model failing, and how have the setbacks over there informed the Administration's policy in this area? Is there any reason to believe that a similar subsidy model in the U.S. would be more economically sustainable and have different results?

A31. Rather than dramatically scaling back support for renewable energy, most European countries are dramatically raising their level of ambition while also adjusting the level of subsidies to reflect the fact that renewable energy continues to grow more cost competitive. For example, the European Commission recently released a "Roadmap to 2050" that suggests reaching 60% of electricity from low carbon technologies in 2020, which would involve even more assertive policy action.

European countries have implemented many policies that motivate rapid deployment of renewable energy, and changes to some of the key policies are not a sign of failure but rather of success. Competition among firms for renewable energy projects leads to cost reductions that effectively increase the profit margins, attracting even more investment. Reflecting the success of well-designed feed-in tariff policies, some European countries have found that their renewable energy markets have grown more rapidly than expected, in some cases outpacing improvements to the electricity grid that are essential to integration of renewable electricity with other sources of generation. In order to ensure a long-term sustainable rate of growth in the industry, some countries have made prudent decisions to reduce the premium payments for renewable electricity to reflect declining cost structure. The adjustment is not a failure, but rather a recognition of fundamental changes in market conditions that make it prudent to lower the incentive payments.

In contrast to other experiences, the feed-in tariff in Spain was not well-designed because it set the premium payment too high, and in an effort to revise the policy, the government retroactively changed the contracts held by all projects already installed, causing a loss of investor confidence. This case is unique.

The Administration has not proposed a federal feed-in tariff although several states are now considering such a policy. Funds for feed-in tariff policies in Europe are collected from ratepayers, and in the United States, ratepayer tariffs are governed by state regulators. The primary federal fiscal policy to motivate renewable energy deployment is a federal tax credit for investment or production.

That being said, it is clear that countries around the world are continuing to invest in clean energy, and in cases such as China, doubling down on those investments. We must choose if we want to lead or follow in a global clean energy economy. The President's proposed CES will help ensure our ability to compete in that global marketplace.

QUESTION FROM REPRESENTATIVE HALL

Yucca Mountain/Nuclear Waste Disposal

Q32a. Over the previous year, the Department of Energy has systematically worked towards permanent closure of Yucca Mountain, despite its designation by law as the site of a nuclear waste repository. Your repeated explanation surrounding the decision to shut down the project is simply that Yucca Mountain isn't a "workable option". In December, President Obama told South Caroline Governor Haley Yucca Mountain was not an option because of "safety concerns."

Do you support the President's assertion that there are valid safety concerns associated with Yucca Mountain? If so, what NRC or DOE documentation can you provide to support his claim?

A32a. The Department has determined that a geologic repository at Yucca Mountain is not a workable option. The reasons for this determination have been explained in filings before the Nuclear Regulatory Commission and the Circuit Court of Appeals for the District of Columbia. I am enclosing for your review relevant excerpts from these filings. The Department of Energy is committed to meeting its obligation to dispose of spent nuclear fuel and high-level radioactive waste. DOE made the decision to terminate the Yucca Mountain project because we can and must do better than Yucca Mountain in meeting that obligation. In particular, Secretary Chu has said that our approach must be both scientifically sound *and* succeed in achieving the necessary consensus of the affected parties, including the communities directly affected. It has been clear for many years that the Yucca Mountain project has not achieved that consensus. On the contrary, it has produced acrimony, dispute, and uncertainty for several decades. In order to chart a better path forward, Congress funded and, at the direction of the President, the Secretary convened the Blue Ribbon Commission on America's Nuclear Future with a mandate to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle.

QUESTION FROM REPRESENTATIVE HALL

Yucca Mountain/Nuclear Waste Disposal

Q32b. Over the previous year, the Department of Energy has systematically worked towards permanent closure of Yucca Mountain, despite its designation by law as the site of a nuclear waste repository. Your repeated explanation surrounding the decision to shut down the project is simply that Yucca Mountain isn't a "workable option". In December, President Obama told South Caroline Governor Haley Yucca Mountain was not an option because of "safety concerns."

The Chairman of the Nuclear Regulatory Commission has prevented the full release of Safety Evaluation Report (SER) document, which details the underlying scientific findings of Yucca Mountain. In the spirit of openness and transparency, do you believe the SER should be released?

A32b. The Department defers to NRC's judgment as to the release of the SER.

QUESTION FROM REPRESENTATIVE HALL

Yucca Mountain/Nuclear Waste Disposal

Q32c. Over the previous year, the Department of Energy has systematically worked towards permanent closure of Yucca Mountain, despite its designation by law as the site of a nuclear waste repository. Your repeated explanation surrounding the decision to shut down the project is simply that Yucca Mountain isn't a "workable option". In December, President Obama told South Caroline Governor Haley Yucca Mountain was not an option because of "safety concerns."

Your testimony notes, "with every initiative the Department undertakes, sound science is at the core." What "sound science" was at the core of your decision to shut down the Yucca Mountain project?"

A32c. As discussed in the answer to question 32a, the Department concluded for a number of reasons that a repository at Yucca Mountain was not a workable option.

QUESTION FROM REPRESENTATIVE HALL

Yucca Mountain/Nuclear Waste Disposal

Q33a. The government has spent over 25 years and upwards of $10 billion to study Yucca Mountain, making it the most studied tract of land in the world. Despite this investment, this Administration refuses to adhere to the Nuclear Waste Policy Act and use Yucca Mountain as a nuclear waste repository. The Blue Ribbon Commission will outline a completely new policy to manage the nation's spent nuclear fuel and assume responsibility for commercial nuclear waste, as directed by law.

What is your estimate of the increase in liability for every year you delay opening the repository and begin accepting spent fuel for disposal?

Q33a. The Department has determined that a geologic repository at Yucca Mountain is not a workable option. The Secretary has established the Blue Ribbon Commission on America's Nuclear Future, and has charged the Commission with identifying alternatives for managing the Nation's nuclear waste. Until the Commission completes its work and proposes alternative solutions, it is not possible to determine to what degree, if at all, implementation of alternative strategies will affect the Government's outstanding liabilities. Nor is it clear that the alternative strategy will take longer than it would have to open a repository at Yucca Mountain, as there are a number of remaining contingencies (including the need for further legislation) beyond the Department's control that could well have delayed substantially the opening of a Yucca repository.

GC Q&A

QUESTION FROM REPRESENTATIVE HALL

Yucca Mountain/Nuclear Waste Disposal

Q33b. The government has spent over 25 years and upwards of $10 billion to study Yucca Mountain, making it the most studied tract of land in the world. Despite this investment, this Administration refuses to adhere to the Nuclear Waste Policy Act and use Yucca Mountain as a nuclear waste repository. The Blue Ribbon Commission will outline a completely new policy to manage the nation's spent nuclear fuel and assume responsibility for commercial nuclear waste, as directed by law.

Did you account for skyrocketing taxpayer liability when calculating the total cost to shutter Yucca Mountain?

A33b. As noted in the response above, until the Blue Ribbon Commission completes its work and proposes alternative solutions, it is not possible to determine to what degree, if at all, implementation of alternative strategies will affect the Government's outstanding liabilities. The Commission may propose alternatives to Yucca Mountain that could well result in waste leaving utility sites more quickly than it would have left had DOE continued to pursue a repository at Yucca Mountain, and thus result in a reduction in the Government's outstanding liabilities.

QUESTION FROM REPRESENTATIVE HALL

Yucca Mountain/Nuclear Waste Disposal

Q34. As you know, the Nuclear Waste Policy Act directly established the Office of Civilian Radioactive Waste Management (OCRWM). On what legal grounds did you unilaterally decide to close OCRWM?

A34. The Department of Energy Organization Act grants the Secretary of Energy broad authority "to establish, alter, consolidate or discontinue such organizational units or components within the Department as he may deem to be necessary and appropriate." See 42 U.S.C. § 7253(a). That discretion does "not extend to the abolition of organizational units or components established by" the Organization Act. But, as you noted, OCRWM was not established by the Organization Act. Rather it was established by the Nuclear Waste Policy Act of 1982. Accordingly, the Secretary has the ability to "alter, consolidate or discontinue" OCRWM as he deems "necessary and appropriate."

QUESTION FROM REPRESENTATIVE HALL

Green Jobs

Q35. A report released by an English business consulting firm examined the costs and benefits of government policy to support the renewable energy industry in United Kingdom. It found that for every job created in the UK in renewable energy, 3.7 jobs are lost. [http://www.bbc.co.uklnews/uk-scotland-12S97097]

The primary reasoning in support of this conclusion is that the opportunity costs associated with pushing consumers to more expensive renewable energy greatly outstrips any benefit from the creation of "green jobs."

What is your reaction to this conclusion that the push for green jobs is economically damaging? If you disagree with the conclusion, can you provide us with independent analyses suggesting otherwise?

A35. The results of the referenced UK study are inconsistent with studies by academia and other independent research entities, some of which are discussed below.

Others analyses: ***Jobs and Cost Study for Pennsylvania Comparing Renewable Electricity to Fossil Fuel Electricity:*** Black & Veatch (Jan 2010) estimated the potential impacts of increasing the renewable portion of Pennsylvania's Alternative Energy Portfolio Standard (AEPS) from the current target of 8 percent in 2009 to 15 percent by 2026: "On a statewide energy consumption basis, $1.6 billion in present value dollars equates to a premium of 0.055 cents/kWh or a 0.6 percent increase over the average 2007 Pennsylvania retail electricity price of 9.08 cents/kWh. Based on an average household monthly electricity consumption of 850 kWh, the AEPS would increase electricity costs per household by about 50 cents per month versus the Fossil Fuel Only (FFO) scenario. In addition, cumulative job impacts in Pennsylvania were calculated (using IMPLAN and RIMSII, commonly accepted jobs analysis tools) to be a cumulative increase of 211,000 job-years for the AEPS scenario, compared to a cumulative increase of only 82,000 job-years for the Fossil Fuel Only scenario.[3]

Potential U.S. Jobs Study: The University of Massachusetts' Political Economy Research Institute analyzed the potential for job creation of investments made in the oil and gas industries compared to investments made in alternative energy sources. Their study indicates that, "With renewable energy, the job creation ranges between 2.5 times to three times more than that for oil and gas." Specifically, for every $1 million expended to produce these energy sources, coal generates 4.9 direct and indirect (supply chain) jobs and wind and solar together generate 19.3 jobs.[4]

Current U.S. Jobs Analysis: The Pew Charitable Trusts conducted a study of actual changes in jobs in the United States between 1998 and 2007, for the clean energy economy compared to total jobs: "...Pew's research shows that between 1998 and 2007, clean energy economy jobs—a mix of white- and blue-collar positions, from scientists and engineers to electricians, machinists and teachers—grew by 9.1 percent, while total jobs grew by only 3.7 percent."[5]

Clarification from the UK study regarding the comment that "for every job created in the UK in renewable energy, 3.7 jobs are lost": The figure of 3.7 is a ratio of an estimate of 10,000 direct jobs (i.e., not including jobs created in the supply chain or broader marketplace) that could be created by one specific potential UK tax policy option, and 2,700 direct jobs attributed to today's UK renewable electricity production, transmission, and distribution. The specific potential UK policy option analyzed by the authors, using input-output modeling, was a reduction in the UK value-added tax from 17.5% to 15%. The lower tax policy option was assumed to have a similar effect on UK consumers' spending habits as avoiding higher household costs of electricity from greater future usage of renewable electricity. How the value to a consumer of this tax cut compared quantitatively to higher electricity costs was not apparent in this study.

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[3] Black & Veatch Project 165569. (January 2010) "Assessment of a 15 Percent Pennsylvania Alternative Energy Portfolio Standard." P. 1-4

[4] Pollin, R.; Heintz, J.; and Garrett-Peltier, H. (June 2009) *The Economic Benefits of Investing in Clean Energy How the economic stimulus program and new legislation can boost U.S. economic growth and employment.* Department of Economics and Political Economy Research Institute (PERI)
University of Massachusetts, Amherst. Pp. 26-30

[5] The Pew Charitable Trusts. (June 2009) "The Clean Energy Economy: Repowering Jobs, Businesses, and Investments Across America."

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q36a. The Office of Science conducts Atmospheric System Research to resolve two areas of uncertainty in the model projections: the role of clouds and the effects of aerosols. This is research that is being conducted at the National Oceanic and Atmospheric Administration (NOAA).

Please describe the difference in the Atmospheric System Research conducted at DOE and the research that is conducted at NOAA.

A36a. DOE Office of Science investments in Atmospheric System Research (ASR) are to understand and model the radiation balance from the surface of the Earth to the top of the atmosphere and to describe how this balance is affected by clouds, aerosols, and increased concentrations of greenhouse gases in the atmosphere. Even though there have been substantial advances in cloud microphysics and aerosol science, current models are still unable to adequately represent the radiative balance in atmospheric models and make climate projections with a high degree of confidence. Our understanding is limited in most part by the interactions between aerosols and both liquid and ice cloud droplets, and the role that precipitation plays in modulating cloud-aerosol interactions. The ASR, at its basis, is coupled to the unique state-of-the-science 24/7 observations from the DOE Atmospheric Radiation Measurement Climate Research Facility (ARM). The ARM is a unique system for observations, capturing fundamental data on cloud and aerosol properties and interactions not captured by NOAA investments. The ASR research priorities respond directly to capability and uncertainty gaps in the Community Earth System Model (CESM), which is jointly funded by DOE and NSF; and the science results from ASR are rapidly assimilated into the CESM architecture, in the form of improved physical process models, with a goal to efficiently improve climate system model performance.

The NOAA research efforts related to clouds and aerosols are complementary to DOE's. In addition to NOAA's broad mission to provide weather forecasting for the Nation to protect life and property, NOAA's portfolio includes a comprehensive atmospheric research program, addressing various aspects of atmospheric chemistry, dispersion modeling, and air quality. NOAA's atmospheric research program is directed specifically toward fulfilling its mission goals of climate, weather, air quality prediction, and satellite observations. In order to fulfill these mission elements, NOAA conducts research on the physical, chemical, and radiative aspects of the earth system through both field and lab studies. While both NOAA and DOE develop models and conduct research, their models are different but complementary, as are their field study programs. Where possible, NOAA and DOE scientists collaborate in different elements of a joint field study with one another to ensure that the most comprehensive, best possible, science is conducted for the benefit of the Nation.

QUESTION FROM REPRESENATIVE HALL

DOE Climate Programs

Q36b. The Office of Science conducts Atmospheric System Research to resolve two areas of uncertainty in the model projections: the role of clouds and the effects of aerosols. This is research that is being conducted at the National Oceanic and Atmospheric Administration (NOAA).

Are the programs duplicative?

A36b. No, the programs are not duplicative. DOE and NOAA coordinate and leverage research capabilities, particularly for field research campaigns, to increase the scientific value of the activity and increase efficiency.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q36c. The Office of Science conducts Atmospheric System Research to resolve two areas of uncertainty in the model projections: the role of clouds and the effects of aerosols. This is research that is being conducted at the National Oceanic and Atmospheric Administration (NOAA).

If these programs are not duplicative, please describe the cooperation between DOE and NOAA in pursuing this line of research.

A36c. Cooperation between DOE/BER and NOAA includes coordination at the program level via U.S. Global Change Research Program, through collaborations with NOAA laboratories such as Earth Systems Research Laboratory (ESRL), and collaborative research campaigns where BER and NOAA assets are exploited. Examples include collaborative field studies and research where NOAA co-locates research experiments and/or short term monitoring activities near a DOE ARM site, and occasions when NOAA and BER share data transmission capabilities when experiments are within the same region.

BER also supports a postdoctoral fellow at NOAA Geophysical Fluid Dynamics Laboratory (GFDL) to enable use of ARM data to improve NOAA GFDL model capabilities and facilitate science-sharing between NOAA and DOE modeling programs. NOAA researchers and program managers also participate in BER scientific workshops and annual principle investigator meetings.

QUESTION FROM REPRESENATIVE HALL

DOE Climate Programs

Q36d. The Office of Science conducts Atmospheric System Research to resolve two areas of uncertainty in the model projections: the role of clouds and the effects of aerosols. This is research that is being conducted at the National Oceanic and Atmospheric Administration (NOAA).

Please explain how this program benefits the American taxpayer.

A36d. Ensuring a safe and secure energy supply for America's future relies on a balanced approach of technology development and risk mitigation. Understanding the Earth's climate system, and how it responds to evolving changes in atmospheric, terrestrial, and ocean-ice conditions, will be important for informed decision-making about energy technologies, including optimal regional technology choices, siting, needs for or impacts to natural resources, and impacts to U.S. ecosystems of international energy technology decisions. DOE Atmospheric System Research investments will advance scientific understanding, validate more advanced versions of climate models, and address the most significant gaps in model performance and capability to help inform understanding of Earth's climate system. DOE recognizes that we must advance climate models more rapidly than has been accomplished in the past and improve estimates in predictions with greater confidence in order to be more responsive to growing needs for predictive information. The improved capacity of climate models will also inform technology design and deployment to help position US industries to more effectively compete for major emerging global markets.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q37a. The Environmental System Science research conducted at DOE is described as providing scientific understanding of the effect of climate change on terrestrial ecosystems and the role of terrestrial ecosystems in global carbon cycling. This research is being conducted at NOAA, NASA, National Science Foundation, the Department of Agriculture, and the U.S. Geological Survey.

Please describe the difference in the global carbon cycle research conducted at DOE and the research that is conducted at the five agencies listed above.

A37a. Each of these partner agencies, NOAA, NASA, NSF, and USDA, has a unique mission that includes research concerning aspects of the global carbon cycle. DOE's mission responsibility for the Nation's future energy technology options drives DOE/BER's goals for fundamental carbon cycle science. DOE's Office of Biological and Environmental Research (BER) terrestrial ecosystems research considers systems extending from bedrock to the top of the plant canopy, and from molecular to global scales. BER also brings unique capabilities and a track record of accomplishments to its research program, relying heavily on DOE National Laboratories, their infrastructure and their abilities to conduct large-scale integrated studies of complex systems including terrestrial ecosystems. BER focuses on studying non-managed terrestrial ecosystems that are globally important and climatically sensitive while requiring that its terrestrial ecosystem research address needs for carbon cycle process information for its Earth system modeling efforts thereby directly contributing to improved representations in the models for integrated Earth systems. This combination of energy mission, system-scale ecosystem research and experiments and close connection to the development and evaluation of integrated Earth system models is unique to and distinctive of DOE/BER's terrestrial ecosystem/global carbon cycle research activities.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q37b. The Environmental System Science research conducted at DOE is described as providing scientific understanding of the effect of climate change on terrestrial ecosystems and the role of terrestrial ecosystems in global carbon cycling. This research is being conducted at NOAA, NASA, National Science Foundation, the Department of Agriculture, and the U.S. Geological Survey.

If the research conducted at these five agencies is not duplicative of the research conducted at DOE, please describe the interagency process for ensuring such duplication does not exist.

A37b. The U.S. Global Change Research Program (USGCRP) provides the mechanism for "a comprehensive and integrated United States research program" to assess global change. Under the auspices of the USGCRP, the Carbon Cycle Interagency Working Group (CCIWG) brings together these six agencies with shared interests in carbon cycle science. The CCIWG is a long-standing and active interagency effort that meets formally every three weeks and supports a number of scientific activities such as the USGCRP's North American Carbon Program, which focuses on understanding the magnitudes, distributions, and dynamic processes controlling of North American carbon sources and sinks on seasonal to centennial time scales. Regular, close and ongoing communication and coordination of the CCIWG ensures appropriate complementary and distinction among the agency programs.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q37c. The Environmental System Science research conducted at DOE is described as providing scientific understanding of the effect of climate change on terrestrial ecosystems and the role of terrestrial ecosystems in global carbon cycling. This research is being conducted at NOAA, NASA, National Science Foundation, the Department of Agriculture, and the U.S. Geological Survey.

Is there a specific plan or roadmap for global carbon cycle research that is used by all six agencies? If so, please provide the plan to the Committee.

A37c. The CCIWG is directed by several products of the scientific community. The community's document "A U.S. carbon cycle science plan" (http://www.carboncyclescience.gov/documents/cc_sp_1999.pdf) and its subsequent report, The First State of the Carbon Cycle Report (SOCCR) (also known as US CCSP Synthesis and Assessment Product 2.2 - http://www.climatescience.gov/Library/sap/sap2-2/final-report/default.htm). These documents provide robust summaries of the scientific communities' understanding of terrestrial carbon cycle as well as science gaps and needs and are used by the agencies of the CCIWG to inform and coordinate research programs and to guide the development of their research plan as captured in the U.S. Global Change Research Program's strategic plans. In late 2008 the scientific community undertook an effort to update the 1999 science plan. Public review of the updated plan has been completed and it currently is in the final stage of revision. Release is expected in the next few months.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q37d. The Environmental System Science research conducted at DOE is described as providing scientific understanding of the effect of climate change on terrestrial ecosystems and the role of terrestrial ecosystems in global carbon cycling. This research is being conducted at NOAA, NASA, National Science Foundation, the Department of Agriculture, and the U.S. Geological Survey.

What are the budget contributions of each of the six agencies to this research?

A37d. The participating federal agencies report their terrestrial ecosystem science research in the annual supplemental budget report to Congress by the U.S. Global Change Research Program. In the most recent edition of this report, "Our Changing Planet," the section on Focus Area 4 (Assessing the Nation's vulnerability to current and anticipated impacts of climate change) summarizes these research efforts by agency. For FY 2011, Focus Area 4 funding for the six agencies listed above is as follows: DOE, $28.6 million; NOAA, $2.2 million; NASA, $0; NSF, $73.3 million; USDA, $43.1 million; and DOI, $17.0 million.[1]

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[1] http://www.globalchange.gov/publications/our-changing-planet-ocp.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q37e. The Environmental System Science research conducted at DOE is described as providing scientific understanding of the effect of climate change on terrestrial ecosystems and the role of terrestrial ecosystems in global carbon cycling. This research is being conducted at NOAA, NASA, National Science Foundation, the Department of Agriculture, and the U.S. Geological Survey.

Please explain why this program benefits the American taxpayer.

A37e. DOE research is making critical measurements and providing new understanding of the processes controlling carbon sinks. This has great relevance to future clean energy development and deployment decisions, as well as to understanding terrestrial ecosystems, natural resources, and the benefits they provide, will change as a result of future changes in the Earth's climate. A major fraction of anthropogenically-emitted carbon is taken up by ecosystems, including approximately 30% of North America's fossil-fuel emissions. Our ability to adapt to natural and anthropogenic global changes requires a sufficient understanding of the role of terrestrial ecosystems in the climate system and the likely responses of ecosystems, including natural resources, to a changing climate. The accuracy of estimates of the future ability of terrestrial ecosystems to absorb a major fraction of emitted carbon is also critical to providing confidence in future climate projections.

Terrestrial ecosystem science provides the basis for the carbon cycle and the role it plays in climate projections. While climate models historically have emphasized atmospheric and oceanic component, there has been a surge in scientific appreciation for the importance of the terrestrial component during the past decade. This surge is in response to estimates of the uncertainty in climate change projections and impacts, that are traced to, for example, thawing permafrost, changing hydrological systems (e.g., water supplies), and increasing frequency of wildfires.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q38a. The Office of Science does Climate and Earth System Modeling to determine the impacts of climate change. Both NOAA and the National Science Foundation have several global climate models.

Please describe the difference in the climate and earth system modeling between DOE and the modeling programs at NOAA and NSF.

A38a. Among DOE, NSF and NOAA, there are only two global climate GCMs, the DOE-NSF supported Community Earth System Model (CESM) and the NOAA supported Geophysical Fluid Dynamics Laboratory (GFDL) climate model. Both of these models are comprehensive, state-of-science, 'gold-standard', and arguably among the top ten worldwide that are able to make both regional and global projections of climate change. The CESM is a community model, built by the research community for the community with thousands of users worldwide. It may be downloaded, developed and studied by anyone and is therefore broadly used by climate researchers in the Universities and Laboratories, including foreign institutions. Scientific priorities for improving the CESM model are based, in part, on gap analyses of all models worldwide, via diagnostic intercomparisons carried out by the DOE/ Office of Biological and Environmental Research (BER) supported Program for Climate Model Diagnostics and Intercomparisons (PCMDI) at Lawrence Livermore National Laboratory.

DOE/BER and NSF have an effective partnership in support of the CESM model. NSF is a crucial supporter of the National Center for Atmospheric Research (NCAR) infrastructure. DOE uses extensive teams and facilities within its national laboratories to provide focused model development of major model components, including the ocean, sea-ice, land-ice, aerosols, atmospheric chemistry, terrestrial carbon cycling, and dynamical cores. DOE/BER contributes about $200 million/year to the CESM activity; this contribution includes direct support to model architecture, science of the model components, model diagnostics, data bases, and intercomparisons with other models, and atmospheric research and ARM infrastructure support to reduce CESM model uncertainty and validate system performance. NSF contributes about $7 million/year directly to the CESM activity, plus more than $10 million of basic research support to universities to study individual climate components and more than $10 million of additional support to NCAR's research and computational activities that the CESM program can effectively leverage. With its major agency-wide thrust in high performance computing, DOE has also provided computational power and expertise, through its internal partnership between BER and ASCR, innovating code design for optimal computation on its petascale computers.

In contrast to the CESM, the GFDL model is built by GFDL for direct support of NOAA's climate mission. GFDL has access to the DOE supported PCMDI, to collaborate in priority setting to advance climate modeling efforts most efficiently.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q38b. The Office of Science does Climate and Earth System Modeling to determine the impacts of climate change. Both NOAA and the National Science Foundation have several global climate models.

How are the efforts of DOE not duplicative with the modeling efforts of NOAA and NSF?

A38b. Both the CESM and GFDL models are among the best in the world and are important contributors to the study of climate variability and change. While both models include the same types of components including the atmosphere, ocean, terrestrial system, and cryosphere, they each use different approaches in carrying out the research and coupling the components into a common system.

The CESM is jointly supported by DOE/BER and NSF and is based on broad scientific input from all DOE national laboratories, the NSF National Center for Atmospheric Research (NCAR), and the broad academic community. While NSF's role is to advance the science by involving single investigator projects, DOE/BER's role is to invest in major national user facilities and large laboratory teams to advance system components. Integration of the NSF and DOE/BER research is carried out by NCAR and the DOE national laboratories. DOE/BER contributes $77 million per year to the CESM activity and has requested this amount in FY 2012; this contribution includes direct support to model architecture, science of the model components, model diagnostics, data bases, intercomparisons with other models, and atmospheric research and ARM infrastructure support to reduce CESM model uncertainty and validate system performance. NSF contributes about $7 million per year directly to the CESM activity, plus more than

$10 million of basic research support to universities to study individual climate components and more than $10 million of additional support to NCAR's research and computational activities that the CESM program can effectively leverage. An additional unique feature of DOE investments is the study and modeling of historical climate change, with an objective to validate and improve the CESM's performance with regards to future climate projections. A new DOE-unique approach to rapidly advance CESM capabilities for an emerging clean energy market is the development of telescoping adaptive grids that will rapidly produce high resolution capabilities in regions of immediate interest. Finally, using DOE national user facilities to diagnose and intercompare all 23 of the world's leading climate models, the CESM priorities are based on best available science and practice within each of the world's leading climate research programs.

Unlike the CESM approach to utilize the talent broadly found in universities, NCAR, and DOE national laboratories, the GFDL approach relies in most part on in-house NOAA research. NOAA/GFDL research emphasizes exploring the individual processes important in determining the climate state, climate predictability and climate projections, novel numerical schemes, data assimilation, extremes in future climates, and ocean modeling. NOAA/GFDL and the rest of the international climate science community are able to share their results at CESM and other international scientists, based on CESM community wide meetings open to NOAA investigators and at scientific conferences. GFDL also has access to the DOE supported user facility at Lawrence Livermore

National Laboratory that in turn diagnoses and evaluates performance of all of the world's leading climate models, including both CESM and GFDL.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q38c. The Office of Science does Climate and Earth System Modeling to determine the impacts of climate change. Both NOAA and the National Science Foundation have several global climate models.

Why is it necessary to have three agencies perform climate modeling?

A38c. It is imperative that multiple models study the climate system, because of the yet unresolved uncertainties in the climate system. Although different climate models appear to simulate 20th century global temperature change effectively, there remain large errors and differences in the details of the climate, such as regional temperature and precipitation changes and extreme events. Moreover, it has been shown that the best estimates of climate change from models are the ensemble average of climate simulations from multiple models. The U.S. Global Change Research Program Synthesis and Assessment Product 3.1, *Climate Models: An Assessment of Strengths and Limitation,* published in 2008, provided an evaluation and comparison of the lead climate models internationally. One of the conclusions of that assessment was that no single current model is superior to others in all respects, but rather different models have differing strengths and weaknesses. Thus the federal agencies continue to pursue the development of a small number of the prevailing international models.

The CESM that is jointly funded by DOE and NSF, and the GFDL model funded by NOAA have been recognized as the leading models in the United States. The models have established the U.S. as a world leader in the study of climate change. The research associated with these models fosters national dialogue on causes and consequences of climate change that would not be possible with only one global climate modeling tool. In addition, the differing approaches of the GFDL and CESM models involving, e.g. numerical methods, grid construction, code development, and model architecture allows a more rapid innovation across the scientific community; lessons learned and best practices developed by each of the modeling teams are discussed during annual meetings and program reviews.

QUESTION FROM REPRESENTATIVE HALL

DOE Climate Programs

Q38d. The Office of Science does Climate and Earth System Modeling to determine the impacts of climate change. Both NOAA and the National Science Foundation have several global climate models.

What is the benefit of this research to the American taxpayer?

A38d. Understanding how and why the Earth's climate will change in the future as a result of changes in atmospheric, terrestrial, ocean, and cryospheric conditions is essential to making informed decisions about future energy technology development and deployment investments, management of natural resources, and national security vulnerabilities. Investments in the development of reliable climate modeling tools are essential for informing multibillion to trillion dollar decision-making processes for infrastructure associated with energy supply and transmission, transport, water management (including freshwater, waste water, and reserves), agriculture, and military facilities. The modeling tools are additionally designed to provide sufficient information on the thresholds, tipping points, and extremes of future climate states.

QUESTION FROM REPRESENTATIVE HALL

Government Accountability Office Report

Q39. Recently, GAO released a report titled, "Opportunities to Reduce Potential Duplication in Government Programs, Save Tax Dollars, and Enhance Revenue."

In the area of achieving federal fleet energy goals, the report identified multiple conflicting statutes and a lack of performance measures, resulting in fleet managers with limited flexibility to meet the goals of reducing the federal fleet's use of petroleum and GHG emissions. This piecemeal and fragmented approach by multiple agencies has led to several conflicts, notably:

- Agencies are required to increase alternative fuel use, although most alternative fuels are not yet widely available. Thus, agencies have been purchasing primarily flex-fueled alternative fuel vehicles (AFVs), those that can operate on E85. However, since E85 was only available at 1 percent of U.S. fueling stations in 2009, agencies are requesting waivers from the requirement to use alternative fuels.

- Under existing law, according to DOE, some vehicles with the lowest GHG emissions do not qualify as AFVs; and according to GSA, some AFVs emit more GHG emissions than some petroleum-fueled vehicles. Thus, by procuring a new vehicle with low GHG emissions the agency may meet the requirement to reduce GHG emissions. but not the requirement to purchase AFVs for its fleet.

- Agencies are encouraged to acquire plug-in hybrids for their fleets when they become publicly available; however, this appears to conflict with other requirements that encourage agencies to reduce electricity consumption in federal facilities - if an agency acquires plug-in vehicles, they may meet the requirement, but this may lead to increased electricity consumption.

What steps have you taken to improve this mess in areas involving DOE?

A39. DOE is unable to address conflicting mandates directly; however, we have recently taken steps to help educate and guide agencies regarding mandates. In April 2010, we published "E.O. 13514 Section 12 Guidance Document" and, in June 2010, we published the complimentary "Handbook on Federal Fleet Management". These two documents provide an overview of Federal fleet requirements. They reframe Federal fleet requirements to encourage agencies to meet the overarching goals (greenhouse gas and petroleum reduction) and, in doing so, also meet related mandates.

DOE also organizes meetings of Federal fleet managers to discuss the various requirements.

QUESTION FROM REPRESENTATIVE HALL

Government Accountability Office Report

Q40. As you know, the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (Pub.L. No. 111-312) extended the 45-cent per gallon federal ethanol tax credit till December 31, 2011. Combined with the Renewable Fuel Standard (RFS), which essentially requires rising use of ethanol and other biofuels from 12.95 billion gallons in 2010 to 36 billion gallons in 2022, this appears to lead to duplicative federal efforts.

The result, according to GAO, is foregone revenues to the Treasury from $5.4 billion in 2010 to $6.75 billion in 2015 when the RFS requirement increases to 15 billion gallons per year. Moreover, GAO noted in the report:

- Importantly, the fuel standard is now at a level high enough to ensure that a market for domestic ethanol production exists in the absence of the ethanol tax credit and may soon itself be at a level beyond what can be consumed by the nation's existing vehicle infrastructure.

In light of these facts, is the Administration reconsidering its position on ethanol subsidies, in particular the federal ethanol tax credit?

A40. Biofuels can play a key role in reducing our dependence on petroleum, and the Administration stands ready to work with Congress to ensure that our biofuels tax incentives are meeting today's challenges and saving taxpayers' money.

QUESTION FROM REPRESENTATIVE HALL

National Lab Staffing

Q41. Please provide a list with the number of full-time equivalents (FTEs) for each National Laboratory for the previous ten fiscal years and the requested FTEs for FY 2012.

A41.

Total Science M&O Contractor Employment Levels

National Laboratory	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011 Req.	FY 2012 Req.
Ames	297	300	317	318	320	313	306	304	308	307	320	314
Argonne	3765	3826	3720	3637	3098	2875	2860	2857	2874	3194	3190	3140
Berkeley	2894	2996	2981	2972	2869	2753	2694	2781	2939	3223	3412	3517
Brookhaven	2848	2840	2771	2720	2565	2516	2615	2669	2815	2945	3000	3020
Fermi	2167	2211	2121	2078	1974	1952	1933	1849	1898	1927	1900	1800
Oak Ridge National Laboratory	3823	3803	3879	3930	4035	4137	4239	4420	4579	4927	4954	4754
Pacific Northwest	3260	3334	3364	3428	3579	3669	3591	3616	3857	4103	4175	4100
Princeton	530	535	446	456	438	432	441	443	457	496	503	430
SLAC	1390	1494	1517	1564	1568	1563	1614	1568	1479	1579	1642	1645
Thomas Jefferson	608	636	661	681	635	600	627	655	660	723	805	799
Total, SC FTE's	**21582**	**21976**	**21777**	**21786**	**21081**	**20811**	**20920**	**21163**	**21866**	**23423**	**23901**	**23519**

Chart presenting NNSA's National Laboratory FTEs are below. This data excludes subcontractors. Employment projections for FY 2011 are planned end of year projections, as year-end values are not yet available. FY 2012 values are based on site allocations consistent with the President's Budget Request.

Total NNSA M&O Contractor Employment Levels

	ACTUAL 2001	ACTUAL 2002	ACTUAL 2003	ACTUAL 2004	ACTUAL 2005	ACTUAL 2006	ACTUAL 2007	ACTUAL 2008	ACTUAL 2009	ACTUAL 2010	PLANNED 2011	PLANNED 2012
LANL	4,463	5,070	5,332	6,017	6,017	6,634	6,363	5,840	5,823	5,709	5,112	5,745
LLNL	4,278	4,711	4,787	4,824	4,807	4,893	4,978	4,665	4,217	4,173	4,244	4,234
SNL	3,957	3,675	4,612	4,696	4,696	5,079	4,437	4,385	4,151	4,240	4,584	4,673
Total	**12,698**	**13,456**	**14,731**	**15,537**	**15,520**	**16,606**	**15,778**	**14,890**	**14,191**	**14,122**	**13,940**	**14,652**

This data Excludes Subcontractors.

QUESTION FROM REPRESENTATIVE HALL

EERE Support Programs

Q42. According to DOE's FY 2011 and FY 2012 budget request documents, appropriations for EERE Strategic Programs subprogram for FY 2009, FY 2009 Recovery Act, 2010, and the FY 2012 request are as follows[11]:

EERE Strategic Programs
(Dollars in Thousands)

Strategic Programs Subprograms[a]	FY2009 Current Appropriation	FY2009 Current Recovery Act Appropriation	FY2010 Current Appropriation	FY2011 Estimated Appropriation	FY2012 Request
Communications & Outreach[b]	8,079	0	11,000		11,559
Innovation & Deployment[c]	0	0	7,000		15,145
International[d]	5,000	0	10,000		12,500
Strategic Priorities & Impact Analysis	0	21,890	6,000		7,000
Planning, Analysis & Evaluation	10,978	0	11,000		7,000
Total Strategic Programs	24,057	21,890	45,000		53,204

[a] Formerly Program Support.
[b] Formerly Technology, Advancement & Outreach
[c] Formerly Commercialization
[d] Formerly Weatherization and Intergovernmental Activities account in FY2009.

Please provide any updates to this table, including FY 2011 estimated appropriations.

A42.

Strategic Programs Subprograms[a]	FY2009 Current Appropriation	FY2009 Current Recovery Act Appropriation	FY2010 Current Appropriation	FY2011 Estimated Appropriation (Cont. Resol.)	FY2012 Request
Communications & Outreach[b]	8,079	0	11,000	11,000	11,559
Innovation & Deployment[c]	0	0	7,000	7,000	15,145
International[d]	0	0	10,000	10,000	12,500
Strategic Priorities & Impact Analysis	0	21,890	6,000	6,000	7,000
Planning, Analysis & Evaluation	10,978	0	11,000	11,000	7,000
Total Strategic Programs	18,157	21,890	45,000	45,000	53,204

QUESTION FROM REPRESENTATIVE HALL

EERE Support Programs

Q43. According to DOE's FY 2011 and FY 2012 budget request documents, appropriations for EERE Strategic Programs subprogram for FY 2009, FY 2009 Recovery Act, 2010, and the FY 2012 requests are as follows[11]:

EERE Strategic Programs
(Dollars in Thousands)

Strategic Programs Subprograms[a]	FY2009 Current Appropriation	FY2009 Current Recovery Act Appropriation	FY2010 Current Appropriation	FY2011 Estimated Appropriation	FY2012 Request
Communications & Outreach[b]	8,079	0	11,000		11,559
Innovation & Deployment[c]	0	0	7,000		15,145
International[d]	5,000	0	10,000		12,500
Strategic Priorities & Impact Analysis	0	21,890	6,000		7,000
Planning, Analysis & Evaluation	10,978	0	11,000		7,000
Total Strategic Programs	24,057	21,890	45,000		53,204

[a] Formerly Program Support.
[b] Formerly Technology, Advancement & Outreach
[c] Formerly Commercialization
[d] Formerly Weatherization and Intergovernmental Activities account in FY2009.

Please provide a listing of the recipients of (i) the $24,057,000 in FY 2009 funding, (ii) the $21,890,000 in FY 2009 Recovery Act funding, (iii) the $45,000,000 in FY 2010 funding, and (iv) any FY 2011 funding to date. Also include this listing each recipient's deliverables and the cost of each such deliverable.

A43. The following tables provide the detailed funding distribution for Strategic Programs (formerly Program Support) funding for (i) FY 2009 Current Appropriation of $24,057,000, (ii) FY 2009 American Recovery and Reinvestment Act (ARRA) funds totaling $21,890,000, (iii) FY 2010 Current Appropriation of $45,000, and (iv) FY 2011 projects funded to date.

FY 2009 Current Appropriation - Strategic Programs

Recipient	Activity	Funding
Communication and Outreach		
Energy Enterprise Solutions, LLC	EERE information center (toll free call center); web management and content	$2,144,645
National Renewable Energy Laboratory	Web content and management; video support services; and event support	$2,112,000
Sentech, Inc.	Communications services and general office support; legislative research and support; events	$1,737,404
The Ad Council	Energy efficiency public service ad campaign	$1,206,000
Highland Technology Services, Inc.	Communications services	$335,000
Dittus Communications, Inc.	Communications services	$300,000
DOE Washington DC Headquarters	Communications services and outreach materials	$108,029
Sandia National Laboratory	Communications services	$50,000
The Media Network, Inc.	Communications services	$42,190
Washington Convention Center	Communications services	$5,000
Subtotal , Communication and Outreach		**$8,040,268**
Planning, Analysis, and Evaluation		
Argonne National Laboratory	Program Input Development and Modeling	$152,000
Brookhaven National Laboratory	Program Input Development and Modeling	$400,000
Golden Field Office	Entrepreneur in Residence	$200,000
Massachusetts Institute Of Technology	MIT Clean Energy Prize	$100,000
Lawrence Berkeley National Laboratory	Model Enhancement and Cooperation with EIA	$40,000
National Renewable Energy Laboratory	Performance Measurement, Portfolio Characterization, Model Enhancement, and additional analysis	$6,224,000
Oak Ridge National Laboratory	Transportation Metrics Analysis	$40,000
Pacific Northwest National Laboratory	Entrepreneur in Residence and Commercialization Analysis	$661,000
Sandia National Laboratory	Program Evaluation	$1,070,000
New West Technologies, LLC	Technical and Analytical Support including Commercialization Analysis	$395,200
Washington Headquarters	Technical and Analytical Support	$84,000
EnergyWorks Joint Venture	Technical and Analytical Support	$550,400
Subtotal, Planning, Analysis & Evaluation		**$9,916,600**
TOTAL, FY 2009 Current Appropriation		**$17,956,868**

FY 2009 ARRA – Strategic Programs - Planning Analysis and Evaluation

Recipient	Activity	Funding
City of Montpelier, VT	Woody Biomass CHP District Heating System – merges heating/electricity needs of Vermont Capital Complex with City Owned buildings and 150+ buildings in downtown district	$8,000,000
Forest County Potawatomi Tribe, WI	Various RE (solar PV, two biogas digesters, small scale biomass district heating loop) projects to help tribe reduce its diesel use and waste	$2,600,000
Phillips County, CO	Utility-scale Community owned wind farm	$2,550,000
Sacramento Municipal Utility District	Various RE projects (solar PV/concentrating solar highway project; 3 biogas digesters to micro turbine applications; one biogas enhancement pilot project) – all expected to be replicable for other communities	$5,050,000
University of California at Davis	Waste-to-energy project – using waste from various university programs	$2,500,000
National Renewable Energy Laboratory	Funds used for technical support at grantees' request	$527,468
Washington Headquarters	Management and Oversight Activities	662,532
Total, FY 2009 ARRA		**$21,890,000**

FY 2010 Current Appropriation - Strategic Programs

Recipient	Activity	Funding
Communications and Outreach		
Energy Enterprise Solutions, LLC	EERE information center (toll free call center); web management and content	$4,533,000
Sentech, Inc.	Communications services and general office support; legislative research and support; events	$3,208,500
National Renewable Energy Laboratory	Web content and management; video support services; and event support	$2,072,200
The Ad Council	Energy efficiency public service ad campaign	$300,000
DOE Washington DC Headquarters	Communications services and outreach materials	$286,432
Energyworks Joint Venture	Communications services and general office support	$250,000
New West Technologies, LLC	Communications services	$149,503
Alliance to Save Energy	Conference sponsorship	$100,000
Cision US, Inc.	News clips and media information	$33,886
ICLEI- Local Governments for Sustainability USA, INC.	Conference sponsorship	$24,000

Oak Ridge National Laboratory	Communications services	$17,129
Highland Technology Services, Inc.	Communications services	$15,000
Northeast Energy Efficiency Partnerships, Inc.	Conference sponsorship	$10,000
Subtotal, Communication & Outreach		**$10,999,650**
Innovation and Deployment		
Energy Enterprise Solutions, LLC	Education & Workforce Development Technical Support	$90,000
National Renewable Energy Laboratory	Education & Workforce Development	$600,000
National Renewable Energy Laboratory	Technology Portal - Technology Commercialization Fund Project	$1,518,181
Washington Headquarters	SBIR/STTR Review/Support	$125,000
National Energy Technology Laboratory	SBIR/STTR Review/Support	$375,000
National Renewable Energy Laboratory	Deployment: Hawaii Clean Energy Initiative	$1,000,000
National Renewable Energy Laboratory	Deployment: Alaska Clean Energy	$500,000
National Renewable Energy Laboratory	Deployment: NSF Office of Polar Programs	$750,000
National Renewable Energy Laboratory	Energy Development in Island Nations, USVI	$500,000
Oak Ridge Operations Office	University Innovation Ecosystems	$1,050,000
Washington Headquarters	Bloomberg-NEF & CleanTech Data, Analysis & Technical support	$491,819
Subtotal, Innovation and Deployment		**$7,000,000**
International		
Argonne National Lab	Program Support and Analysis	$50,000
Alliance to Save Energy	Energy Efficiency Codes Cooperation and Conference Support, International Partnership for Energy Efficiency Collaboration (IPEEC)--Policy Committee	$466,000
Brookhaven National Lab	India Cities partnership, Energy Efficiency partnership with the Ministry of Urban Development, Times Business Solutions, Ahmedabad Municipal Buildings, Surat Energy Policy, AIILSG Energy Course, Energy Smart Schools	$300,000
Energy Enterprise Solutions, LLC	EERE International Website	$15,000

Washington Headquarters	Foreign Service National, USTDA-- Orientation Visit for Chinese Mayors, Interfax Subscription, Intl Contractor Support, ICASS Fees, Foreign Service National, IPEEC	$611,000
Bi-national Industrial Research and Development	Technology Development and Commercialization Solicitation, per EISA 917	$2,000,000
Lawrence Berkeley National Lab	China Buildings EE Analysis, Data Center Initiative, Policy Studies, Program Support and Analysis, Sustainable Cities, IPEEC, Eco-City Partnerships, International Energy Agency (IEA) Global Energy Assessment input, Asia-Pacific Partnership Buildings and A	$1,750,000
National Association of State Energy Officials	Buildings Exhibit/Shanghai Energy Conservation Museum Project/City Pairings and Technical Assistance	$200,000
New West Technologies, LLC	Intl Contractor Support, IPEEC	$211,000
National Renewable Energy Lab	CLEAN Partnership, Open Energy Information website, U.S.-Canada Clean Energy Dialogue Technical Support, Advanced Solar R&D, Advanced Wind R&D, Grid Integration, RE Advisory Group, Renewable Electric Roadmap, Technology Standards, Program Support and Analy	$3,010,000
Oak Ridge National Lab	Advance understanding and application of GSHPs in China and India , program support and analysis, Save Energy Now training, building assessments and design charettes, software tools	$380,000
Pacific Northwest National Lab	Documenting Code Enforcement Systems in China and Technical Assistance, Joint R&D on Thermochemical Conversion of Biomass to Mixed Alcohols and Integrated Approach for Biomass Conversion to Fuels Projects, Compliance tools, APP Codes development, Russia	$1,007,000
Subtotal, International		**$10,000,000**
Strategic Programs Impact Analysis		
Argonne National Laboratory	Transportation Energy Futures	$250,000
Lawrence Berkeley National Laboratory	Intergovernmental Panel on Climate Change chapter and State Energy Efficiency Action Network activities	$230,000
Oak Ridge National Laboratory	State Energy Efficiency Action Network and industrial energy efficiency analysis	$100,000
Oak Ridge Operations Office	University Innovation Ecosystems	$422,000
Sentech, Inc.	Supply Chain Analysis	$94,000
Navigant	Energy Efficiency Analysis	$100,000

EnergyWorks Joint Venture	Technical and Analytical Support	$700,000
National Renewable Energy Laboratory	Renewable Electricity Futures, Building Energy Futures, Transportation Energy Futures, Industry Energy Futures, and additional analysis	$4,104,000
Subtotal, Strategic Program Impact Analysis		**$6,000,000**
Planning, Analysis and Evaluation		
Argonne National Laboratory	Benefits and Behavioral Analysis	$310,000
Brookhaven National Laboratory	Program Input Development and Modeling (Project ID:19458)	$440,000
Golden Field Office	Smart Power	$50,000
Lawrence Berkeley National Laboratory	Representation of Energy Efficiency in Models	$125,000
National Renewable Energy Laboratory	Benefits Analysis, Model Enhancement and Development, Collaborative Analysis	$6,949,500
Oak Ridge National Laboratory	Behavioral Analysis	$150,000
Oak Ridge Operations Office	University Innovation Ecosystems	$278,000
Pacific Northwest National Laboratory	Program Input Development and Modeling, Intensity Indicators and additional analysis	$485,000
Sandia National Laboratory	Program Evaluation	$1,500,000
Washington Headquarters	Planning and Technical Support	$712,500
Subtotal, Planning, Analysis and Evaluation		**$11,000,000**
Total, FY 2010 Current Appropriation		**$44,999,650**

FY 2011 Strategic Programs - Funding to Date

Recipient	Activity	Funding
Communication and Outreach		
Energy Enterprise Solutions, LLC	EERE information center (toll free call center); web management and content	$3,175,500
Sentech, Inc.	Communications services and general office support; legislative research and support; events	$2,500,000
National Renewable Energy Laboratory	Web content and management; video support services; and event support	$1,454,200
National Energy Technology Laboratory	Communications services	$800,000
The Ad Council	Energy efficiency public service ad campaign	$613,446
Energyworks Joint Venture	Communications services and general office support	$200,000
Alliance to Save Energy	Conference sponsorship	$24,000
DOE Washington DC Headquarters	Communications services and outreach materials	$17,000
Subtotal, Communications and Outreach		**$8,784,146**
Innovation and Deployment		
Argonne National Laboratory	Education & Workforce Development Technical Support	$200,000
Oak Ridge Operations Office	SBIR/STTR Review/Support	$450,000
Energy Enterprise Solutions, LLC	Education & Workforce Development	$350,000
Subtotal, Innovation and Deployment		**$1,000,000**
International		
Argonne National Lab	Natural Gas Bus Conversion	$35,000
Lawrence Berkeley National Lab	Geothermal Technical Cooperation	$14,368
National Renewable Energy Lab	Masdar building EE and PV, Program Support and Quick Response, Technical Integration	$500,000
Washington Headquarters	Green & Intelligent Buildings Conference Co-sponsorship	$76,000
Subtotal, International		**$625,368**
Strategic Priorities and Impact Analysis		
Lawrence Berkeley National Laboratory	Intergovernmental Panel on Climate Change chapter and Cook Stoves Analysis	$240,000
Subtotal, Strategic Priorities and Impact Analysis		$240,000
Planning, Analysis and Evaluation		
Golden Field Office	Smart Power	$150,000
Subtotal, Planning Analysis and Evaluation		**$150,000**
Total, FY 2011 Strategic Programs		**$10,799,514**

QUESTION FROM REPRESENTATIVE BARTLETT

Q1. In view of this trend of greater fuel-use in the heavy duty sector, and the lack of any clear alternatives for Heavy Duty vehicles, why has DOE chosen to focus huge sums on Light Duty and substantially less by comparison on Heavy Duty?

A1. The Department's support of light-duty vehicle technologies generally reflects their significant contribution to highway transportation energy use, compared to other vehicle classes: light-duty vehicles account for 76% and heavy trucks account for 19% of U.S. highway transportation energy use (buses and medium trucks account for the remaining 5%). It is important to note, however, that much of the Vehicle Technologies budget supports the development of technologies applicable to both light-duty vehicles and heavy-duty vehicles, such as advanced combustion, hybridization, and lightweight materials. SuperTruck projects, for example, are using hybrid and lightweight materials technologies to improve the efficiency of class 8 trucks. In addition, the Department's ehicle Technologies Program facilitates communication across the research community to leverage technology development and expertise that can benefit multiple vehicle classes. Among the most recent examples, the Program hosted a roadmapping workshop in March that brought together manufacturers and suppliers from the light-duty and heavy-duty vehicle communities to discuss research needs, technical targets, and strategies.

QUESTION FROM REPRESENTATIVE BARTLETT

Q2. Why, after finally focusing on an integrated vehicle approach to Heavy Duty R&D, has DOE quickly reversed, even before providing any chance to demonstrate success?

A2. The Department is working to fund completely all SuperTruck projects. Two of the three projects awarded are fully funded. The Department is looking at ways to continue funding the third project within the fiscal year 2012 (FY12) budget request, recognizing that this integrated project includes research and development efforts that cut across several program activities including energy storage, light weighting, and vehicle systems.

QUESTION FROM REPRESENTATIVE HULTGREN

Q1. Secretary Chu, I am concerned about funding for the Department of Energy's (DOE) Office of Science, and specifically the Higher Energy Physics program, which is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at the Fermi National Accelerator Laboratory (Fermilab) as originally planned at the end of FY 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs, including the Long Baseline Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota.

It is my understanding that the President has proposed $32 million for DUSEL and LBNE in his FY 2012 budget request for DOE. I also understand that the Department stepped in when it became clear that a new stewardship agreement would be needed between DOE and the National Science Foundation (NSF) while a study is conducted and decisions are made on a path forward for the project.

Mr. Secretary, what is the current status of LBNE? Has NSF identified the resources to keep DUSEL underway during this interim period while the study is conducted and a revised project is developed?

A1. The LBNE Project is preparing material on cost-effective options for the experiment at the Homestake Mine that will be submitted to the DOE for review. To maintain the viability of the Homestake mine while the DOE assessment is carried out, DOE and NSF have agreed to the following: NSF will provide up to $4,000,000 to bridge an approximately four month funding gap between June to September 2011 to keep the Homestake Mine dry through FY 2011. The Office of Science has requested $15,000,000 in FY 2012 for continued de-watering and minimal sustaining operations.

QUESTION FROM REPRESENTATIVE HULTGREN

Q2. Secretary Chu, I am concerned about funding for the Department of Energy's (DOE) Office of Science, and specifically the Higher Energy Physics program, which is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at the Fermi National Accelerator Laboratory (Fermilab) as originally planned at the end of FY 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs, including the Long Baseline Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota.

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. The President's FY 2012 budget request of $797.2 million for High Energy Physics overall would amount to a freeze at the FY 2010 enacted level when other programs within the Office of Science are slated for increases of from 21 to 24 percent. Why is there such an imbalance in the basic research portfolio of the Office of Science?

A2. The High Energy Physics program is in transition and the President's request carefully balances tradeoffs between new investments and concluding activities. The request includes investments in future capabilities and new research directions, while other activities, such as the Tevatron operations, come to an end.

QUESTION FROM REPRESENTATIVE HULTGREN

Q3. Secretary Chu, I am concerned about funding for the Department of Energy's (DOE) Office of Science, and specifically the Higher Energy Physics program, which is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at the Fermi National Accelerator Laboratory (Fermilab) as originally planned at the end of FY 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs, including the Long Baseline Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota.

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. High Energy Physics is an international field with researchers around the world building complex experiments and collaborating on research at these facilities. What message are you sending to the international scientific community with essentially a freeze on the program?

A3. The President's request includes support for robust participation in international collaborations such as the LHC, the Daya Bay neutrino experiment in China, and the B-Factory and neutrino experiments in Japan. Furthermore, we are continually engaged with our international partners as we chart our course for new capabilities and new research directions. Our international partners understand that the U.S. is not retreating from the scientific frontier, but consolidating its position and defining a more focused future program where the U.S. will lead in selected high priority research areas that benefit the nation near and long term.

QUESTION FROM REPRESENTATIVE HULTGREN

Q4. Secretary Chu, I am concerned about funding for the Department of Energy's (DOE) Office of Science, and specifically the Higher Energy Physics program, which is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at the Fermi National Accelerator Laboratory (Fermilab) as originally planned at the end of FY 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs, including the Long Baseline Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota.

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Within the overall funding request for High Energy Physics for FY 2012, are there the necessary investments that will allow Fermilab to make the transition to the new projects critical to its future as the nation's only laboratory for particle physics research?

A4. Yes. The FY 2012 request supports two initiatives for significant future capabilities at Fermilab: the Long Baseline Neutrino Experiment, and the Muon to Electron Conversion Experiment. These are in addition to continued investment in current and near term experiments based at the Fermilab campus, including MINOS, MicroBooNE, NOvA, and other research and development activities. The Office of High Energy Physics works closely with Fermilab to further develop the laboratory's capabilities to support current and future research directions in High Energy Physics.

QUESTION FROM REPRESENTATIVE HULTGREN

Q5. Secretary Chu, I am concerned about funding for the Department of Energy's (DOE) Office of Science, and specifically the Higher Energy Physics program, which is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at the Fermi National Accelerator Laboratory (Fermilab) as originally planned at the end of FY 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs, including the Long Baseline Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota.

It is my understanding that the President has proposed $32 million for DUSEL and LBNE in his FY 2012 budget request for DOE. I also understand that the Department stepped in when it became clear that a new stewardship agreement would be needed between DOE and the National Science Foundation (NSF) while a study is conducted and decisions are made on a path forward for the project.

Is the $17 million requested for the Long Baseline Neutrino Experiment sufficient to start this project as Fermilab transitions from running the Tevatron? Is this request sufficient to make up for the loss of work for FY 2011?

A5. The total funding requested in FY 2012 is $24 million with $17 million being allocated for Project Engineering and Design (PED) funds and another $7 million for Other Project Costs. The pace of this project has been slowed to allow for DOE's assessment of alternative locations for the LBNE far detector, including the Homestake mine, and it will not be possible to completely make up the loss of work in FY 2011.

QUESTION FROM REPRESENTATIVE HULTGREN

Q6. Secretary Chu, I am concerned about funding for the Department of Energy's (DOE) Office of Science, and specifically the Higher Energy Physics program, which is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at the Fermi National Accelerator Laboratory (Fermilab) as originally planned at the end of FY 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs, including the Long Baseline Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota.

It is my understanding that the President has proposed $32 million for DUSEL and LBNE in his FY 2012 budget request for DOE. I also understand that the Department stepped in when it became clear that a new stewardship agreement would be needed between DOE and the National Science Foundation (NSF) while a study is conducted and decisions are made on a path forward for the project.

I note that the President's budget request for NSF proposed to terminate the DUSEL project for estimated savings of $36 million? Is the $15 million in the FY 2012 budget request for DOE sufficient to sustain the work at the DUSEL site while a new project profile is developed?

A6. Yes. The $15 million is intended to maintain the viability of the Homestake Mine as DOE assesses alternative locations for neutrino, dark matter, and beta decay experiments that are planned by the Office of Science High Energy Physics and Nuclear Physics programs.

QUESTION FROM REPRESENTATIVE HULTGREN

Q7. Secretary Chu, I am concerned about funding for the Department of Energy's (DOE) Office of Science, and specifically the Higher Energy Physics program, which is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at the Fermi National Accelerator Laboratory (Fermilab) as originally planned at the end of FY 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs, including the Long Baseline Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota.

It is my understanding that the President has proposed $32 million for DUSEL and LBNE in his FY 2012 budget request for DOE. I also understand that the Department stepped in when it became clear that a new stewardship agreement would be needed between DOE and the National Science Foundation (NSF) while a study is conducted and decisions are made on a path forward for the project.

Do you feel that the $32 million you are proposing for FY 2012 is sufficient to maintain progress on this important national facility, leveraging the more than $250 million invested to date in private, state, and federal funds?

A7. The FY 2012 Office of Science request includes $24 million for LBNE and $15 million for continued pumping and minimal sustaining operation at the Homestake mine. This funding is adequate to maintain progress on LBNE and preserve the viability of the Homestake mine during the time DOE assesses cost effective options for achieving the science it had planned.

QUESTION FROM REPRESENTATIVE HULTGREN

Q8. Mr. Secretary, I am very interested in promoting alternative energy sources such as wind and solar. My understanding is that one of the issues that is emerging with wind turbine technology is the question of the reliability and longevity of this infrastructure.

What is the department doing to support research efforts aimed at improving the reliability and longevity of wind turbine technology through retrofits of existing turbines or the development of wind turbines that have longer live cycles?

A8. The Department's Wind Program has several research projects directly addressing the reliability and longevity of wind turbines. These efforts include the Continuous Reliability Enhancement for Wind (CREW) database, The Gearbox Reliability Collaborative and The Blade Reliability Collaborative. The Department's Wind Program also supports a number of testing facilities that are used for drivetrain and blade research and certification efforts, which also support the goals of reliability and longevity.

The CREW database project is characterizing wind turbine reliability and performance issues at operational wind farms. Data collected in the CREW database will be used to guide future Wind Program R&D investment by identifying critical issues, determining the relative impact of component failures, and providing data on the root cause of component failures.

The Gearbox Reliability Collaborative is led by the Department's National Renewable Energy Laboratory and includes participants from wind turbine owners/operators; manufacturers of wind turbines, gearboxes and bearings; the lubrication industry; industry consultants; academia and other DOE national laboratories. The Gearbox Reliability Collaborative is identifying deficiencies in the design process that contribute to substantial shortfalls in service life for many current gearbox designs.

The Blade Reliability Collaborative is led by the Department's Sandia National Laboratory and includes participants from industry, academia, and the Department's National Renewable Energy Laboratory. The goals of this collaborative are to identify the most prevalent sources of blade failure, determine the most effective method to detect defects and damage, classify the severity and criticality of prominent defects, and assess the ability of modeling tools and test methods to predict the effect of defects and damage on operating blades.

With the help of funding from the Recovery Act, the Department has established two new independent research and testing facilities and is also upgrading the facilities at the National Wind Technology Center operated by the Department's National Renewable Energy Laboratory. The Massachusetts Large Blade Test Facility in Boston, MA, funded with $25M from the Recovery Act, will enable research and certification testing of large rotor blades up to 90 meters long. The Clemson University Wind Turbine Drive Train Test Facility in North Charleston, SC, funded with $45M from the Recovery Act, will include 7.5MW and 15MW dynamometer test stands for research and certification testing of wind turbine drivetrains. The National Wind Technology Center in Broomfield, CO, funded with $10M from the Recovery Act, will add a 5MW dynamometer to complement the existing 2.5MW dynamometer for research and certification testing of wind turbine drivetrains. The research and certification testing at these facilities are aimed at determining whether the drivetrains and blades that are tested will reliably meet their design lifetimes.

In summary, the Department has made a commitment to address wind turbine reliability as a major part of its research agenda, and it will continue to maintain reliability testing and R&D as a priority under the proposed FY 2012 budget.

QUESTION FROM REPRESENTATIVE HULTGREN

Q9. Another very fundamental issue is the question of how we transfer wind and solar generated energy technology into the electricity grid in an effective and organized manner – this requires consideration of issues such as system balance, energy storage and transmission. Can you tell me what the Department is doing in terms of research to address the basic challenges involved in mapping wind and solar generated energy into the electrical grid?

A9. Efforts to ensure variable renewable energy sources like solar and wind are integrated efficiently into the electrical grid are coordinated between the Office of Electricity Delivery and Energy Reliability (OE) and the Office of Energy Efficiency and Renewable Energy (EERE). One of the key efforts being coordinated between the two Offices to better understand the impact of high levels of renewable deployment are the second phases of the Eastern Wind Integration and Transmission Study and the Western Wind and Solar Integration Study.

In addition, OE is funding collaborative approaches for long-term transmission planning at the interconnection level. These projects will determine the transmission requirements associated with a broad range of electricity supply futures, including intensive development of renewable resources. On the technology side, OE is investing in research and development activities that will contribute to a robust electrical infrastructure that can support a wide variety of energy sources. This includes efforts to expand wide-area situational awareness (through widespread deployment of phasor measurement units and smart grid devices) to address operational variability associated with renewables. In the energy storage arena, OE is supporting, for example, compressed air energy storage projects in Iowa, California, and New York to absorb nighttime wind power from the Great Plains and deliver day time peak power, as well as applying energy storage technologies to reduce intermittency issues associated with solar generation in New Mexico and California.

Within EERE's Wind and Water Power Program, efforts are underway to better understand reliability impacts of wind deployment though analysis of wind providing frequency response; wind integration studies are being conducted with support from experts at national labs to various utilities; analysis is being done on coordinated dispatch and operations between utilities to aid in wind deployment; work is being conducted on the development and validation of non-proprietary wind generator models for use by system planners; efforts are being made to improve wind forecasting and increase its use by operators; and the Office is working to establish methodologies for determining the impacts for reserves needed in systems with high levels of wind.

The Department's Solar Energy Technology Program (SETP) in EERE is also addressing how to integrate high penetrations of solar technologies in a safe, reliable, and cost-effective manner. Through the SunShot Initiative, the Department has set a goal to achieve grid parity without subsidies and thus become competitive with fossil fuel throughout the U.S. and world by making solar a dollar-a-watt ($/w pr 4-5 cents/kWh equivalent). The Systems Integration subprogram is an important component in reaching this goal and will help allow for the seamless system integration of solar technologies. Important areas of research include acquiring the field data needed to support modeling (production cost modeling, solar plant production modeling), analysis (grid impacts, variability, ramps), demonstration, and validation. Additionally, developing validated inverter and system models and simulation tools to support analysis of solar integration will be a key area for research, while utilizing power system models and tools will help us understand the effects of large solar penetrations on the transmission grid. SETP is also working on addressing and quantifying the variability and uncertainty of the solar energy system output (e.g., field data collection) and developing solutions (e.g., short-term and long-term forecasting, curtailment, market structure, storage) that minimize the impact solar technologies have on electric power systems operations.

QUESTION FROM REPRESENTATIVE ADAMS

Q1. Does the Secretary believe the department's proposal for $3.6 billion in increased taxes on oil and natural gas comes at the right time given the highest average gas prices we have ever seen in this country?

A1. First of all, the Administration's budget request includes repeal of subsidies for industries making record profits. Oil and gas production are mature technologies that do not need continued federal government support for production. The oil industry in particular has enjoyed subsidies for almost 100 years, and the Administration believes that private industry can adequately fund their exploration and production activities without help from the U.S. taxpayers.

QUESTION FROM REPRESENTATIVE ADAMS

Q2. Currently the Federal Government spends more than $8 billion across 16 agencies to conduct climate change research. How would the Secretary justify the billions that the Department of Energy is spending on this same research in light of the duplication.

A2. Understanding the Earth's climate system, including its atmospheric, oceanic, terrestrial, and cryospheric components, is one of the universal grand challenge science questions of our time. Understanding how the Earth's climate will change in the future also has broad implications for meeting the energy demands of a growing population, managing increasingly scarce or vulnerable natural resources, and identifying and addressing emerging national security concerns. Climate science across the federal government provides critical new knowledge on the core components of the climate system. Each agency contributing to the national investments in climate science research does so with the goal of addressing their mission, capitalizing on their core strengths and competencies, and leveraging the expertise and investments of other federal agencies. The federal investment in climate science spans experimental field research, global observations and measurements using surface and space-based platforms, modeling, and integrated assessment research on impacts of climate on energy, water, and agriculture.

Much of the $2.6 billion proposed for the federal investment in climate science in the 2012 Budget, coordinated through the U.S. Global Change Research Program, involves NASA and NOAA satellites that collect climate data and surface weather and ocean observation networks. A fraction of the investment is dedicated to studying the science of climate change and the development of predictive models for use by decision makers. DOE's current total investment of about $200 million (with $250 million proposed in FY 2012) is for basic research on clouds, aerosols, terrestrial carbon cycling, the development of a multi-compartment, high resolution earth system model, and impacts of future projections on energy systems.

Energy planners need reliable, robust modeling tools for assessing risks and informing major energy investment decisions, and they need them sooner rather than later. The Department's mission is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. In order for the mission to be sustained, DOE must make science and technology investments that advance the efficiency and affordability and minimize the deployment risk of all possible energy technologies. While scientific investments that advance energy technologies rely on discoveries in material, biological, and chemical sciences, parallel scientific research that minimizes design and deployment risk requires accurate descriptions of long-term weather patterns and extremes over infrastructure lifetimes. Extremes include frequencies of hurricanes, floods, droughts, heat waves, etc. How these events might change and in turn impact the farming of bioenergy crops and/or siting of wind energy farms is a risk the DOE and industries need to examine. The modeling and prediction tools developed by DOE are based in most part on BER-supported science, and the DOE participation in USGCRP allows science developed by other agencies (including NOAA, USDA, USGS, NSF, and NASA) to be rapidly assimilated into our prediction capabilities. It is both the uniqueness and mission-value of the BER science as well as the USGCRP framework that allows rapid assimilation of other agency research products that has resulted in BER preeminence and best-in-class stature in climate prediction capabilities. With this approach, these capabilities are also serving to contribute to the energy component of the Nation's strategic economic security.

QUESTION FROM REPRESENTATIVE ADAMS

Q3. Please provide the names, titles, salaries and tenures of all staff members at the Department of Energy who are, or were, paid to design and implement your educational programs with the online games and energy action lists that ask children to, "talk to your parents about energy star appliances, programmable digital thermostats, and home improvements."

A3. These products were administered by the Office of Energy Efficiency and Renewable Energy, under former Assistant Secretary Andy Karsner. The products were made available in the fall of 2008. They have remained in EERE's corporate web sites since that time. Mr. Phil West, Director of Communications and Outreach, presently oversees EERE's corporate web sites.

QUESTION FROM REPRESENTATIVE ADAMS

Q4. Over the previous year, the Department of Energy has systematically worked towards permanent closure of Yucca Mountain. Does the Secretary support the President's assertion that there are valid safety concerns associated with Yucca Mountain?

A4. The Department has determined that a geologic repository at Yucca Mountain is not a workable option. The reasons for this determination have been explained in filings before the Nuclear Regulatory Commission and the Circuit Court of Appeals for the District of Columbia. I am enclosing for your review relevant excerpts from those filings.

The Department of Energy is committed to meeting its obligation to dispose of spent nuclear fuel and high-level radioactive waste. DOE made the decision to terminate the Yucca Mountain project because we can and must do better than Yucca Mountain in meeting that obligation. In particular, Secretary Chu has said that our approach must be both scientifically sound *and* succeed in achieving the necessary consensus of the affected parties, including the communities directly affected. It has been clear for many years that the Yucca Mountain project has not achieved that consensus. On the contrary, it has produced acrimony, dispute, and uncertainty for several decades. In order to chart a better path forward, Congress funded and, at the direction of the President, the Secretary convened the Blue Ribbon Commission on America's Nuclear Future with a mandate to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle.

QUESTION FROM REPRESENTATIVE ADAMS

Q5. What authority has Congress given Department of Energy to withdraw the Yucca Mountain NRC application? How many employees were laid off as a result of terminating contracts associated with Yucca Mountain? It is my understanding that many documents and scientific evidence was removed from Yucca Mountain; where is the information now? What scientific evidence is DOE using to justify this attempt to withdraw the Yucca Mountain application?

A5. The Department has determined that a geologic repository at Yucca Mountain is not a workable option. The reasons for this determination have been explained in filings before the Nuclear Regulatory Commission and the Circuit Court of Appeals for the District of Columbia. I am enclosing for your review relevant excerpts from these filings. The Motion to Withdraw was filed consistent with the Nuclear Waste Policy Act and existing NRC procedures applicable to such applications. An appeal of the licensing board's denial of this motion is pending before the Commission.

DOE made the decision to terminate the Yucca Mountain project because we can and must do better than Yucca Mountain in meeting that obligation. In particular, Secretary Chu has said that our approach must be both scientifically sound *and* succeed in achieving the necessary consensus of the affected parties, including the communities directly affected. It has been clear for many years that the Yucca Mountain project has not achieved that consensus. On the contrary, it has produced acrimony, dispute, and uncertainty for several decades. In order to chart a better path forward, Congress funded and, at the direction of the President, the Secretary convened the Blue Ribbon Commission on America's Nuclear Future with a mandate to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle

The Department does not have an estimate of how many contractor employees were laid off by their employers as a result of terminating or descoping contracts related to the termination of the Yucca Mountain. As a result of the closure of the Office of Civilian Radioactive Management (OCRWM), only three of the 184 federal OCRWM personnel were involuntarily separated on September 30, 2010.

The Department has taken extensive efforts to preserve scientific information and data related to a repository at Yucca Mountain and the storage and disposal of spent nuclear fuel and high-level radioactive waste. The data storage systems were never located at the Yucca Mountain site. The Department has preserved the data on these systems. Most of the data is or will be preserved at the Department's facility in Morgantown, West Virginia. Scientific evidence such as test samples is being maintained at the Nevada National Security Site or at other secure locations.

QUESTION FROM REPRESENTATIVE ADAMS

Q6. Does the secretary believe that the $2 billion increases in "clean energy'· spending on programs that have already received dramatic increases, including $17 billion in Stimulus spending, are the best use of Taxpayer money?

A6. The Department believes that increasing funding for innovative clean energy technologies is essential to promoting the future of American competitiveness and energy security. These investments will help promote new domestic industries that create high quality jobs and important manufacturing capabilities. While the Recovery Act provided an important injection of capital and tax credits into the private markets, continued government investment in R&D is critical to the development of early stage technologies.

QUESTION FROM REPRESENTATIVE PALAZZO

Q1. Secretary Chu, now during this challenging time of record oil prices, record deficit spending and record unemployment can this administration support spending billions of dollars to support an 80 percent clean energy objective that cannot be reasonably met when our country is blessed with an abundance of fossil based natural resources that have proven to be cost effective for both the consumer and producer and can quickly create thousands of jobs for Mississippians and Americans?

A1. The President's clean energy goal is defined very broadly to include renewable, nuclear power, efficient natural gas, and coal with carbon capture and sequestration. The breadth of this proposal is precisely why the target can be reasonably met with technologies ranging from wind and solar to innovative fossil technologies and many technologies available today. In addition, over time, the clean energy standard will unlock the potential and provide the incentive to develop new, low-cost clean technologies that will create new American businesses and reduce costs to consumers while driving our ability to compete with other countries around the globe making sizable investments in clean energy.

QUESTION FROM REPRESENTATIVE PALAZZO

Q2. What steps are being taken by the administration to ensure rising fuel prices do not have the same economic impact on the economy that we witnessed in the summer of 2008 when prices spiked at the pump at $4.00 per gallon?

A2. As the President said in his speech at the end of March, we understand burden gas prices put on millions of Americans already struggling, and we are focused on how to protect American consumers against rising oil prices while securing our energy future. When President Obama took office, America imported 11 million barrels of oil a day. He has pledged that by a little more than a decade from now, we will have cut that by one-third, and put forward a plan to secure America's energy future by producing more oil at home and reducing our dependence on oil by leveraging cleaner, alternative fuels and greater efficiency. The Administration's *Blueprint for a Secure Energy Future* outlines the comprehensive national energy policy that this Administration has pursued since day one, and which we will build upon to secure our energy future. It includes a comprehensive program to develop and secure our energy supplies, provide consumers with choices to reduce costs and save energy, and to innovate new and cleaner energy technology.

QUESTION FROM REPRESENTATIVE PALAZZO

Q3. According to the Energy Information Administration gas prices peaked the week of July 14, 2008. On July 14, 2008, President George W. Bush lifted the executive prohibition on oil exploration in the Outer Continental Shelf (OCS) to allow for increased access to offshore exploration. At that point, pump prices decreased sharply each week bottoming out in late December 2008. In the wake of the BP Deep Water Horizon oil spill President Obama issued a moratorium on offshore drilling. Nearly a year later, a de-facto moratorium remains as the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) has only authorized one drilling permit out of 103 requested in the Gulf of Mexico. This has come with a particularly devastating economic impact to South Mississippi. If President Obama immediately permitted the outstanding requests and allowed for new drilling in the Gulf of Mexico, would it put downward pressure on gas prices? Moreover, would easing restrictions OCS exploration nationwide put downward pressure on gas prices?

A3. The Department of Energy has no regulatory or permitting role with respect to oil exploration in the Outer Continental Shelf (OCS).

QUESTION FROM REPRESENTATIVE JOHNSON

Q1a. Arguments used to oppose investments in applied research on new energy technologies appear to center on the following two assumptions: if it is worth doing, then market forces will drive private sector entities to do it on their own; and, taxpayer investment in technology innovation skews market forces and amounts to the government picking winners and losers. This debate is somewhat confused by the fact that the terms "basic research" and "applied research" have different meanings to different people. Activities that policymakers and agencies consider to be applied research may often be considered by the private sector to be basic research that is far too underdeveloped to warrant significant investment by the private sector.

How do you respond to these two assumptions as they are used to justify cuts to applied R&D?

A1a. Department of Energy (DOE) support of basic research leading to scientific discoveries, applied research and development, and concept demonstration is necessary to stimulate private investment in innovative new energy technologies that will build our future energy independence. DOE and its predecessor agencies have a well established track record in providing results necessary for the early stages of energy sector innovation through basic research discoveries in the Office of Science and support of applied research and development efforts in the DOE technology programs.

The Department's "basic research" and "applied research" activities are defined by the Office of Management and Budget (OMB Circular No. A–11). OMB categorizes all government R&D funding by these definitions. "Basic research" is defined as systematic study directed toward fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. Basic research, however, may include activities with broad applications in mind. "Applied research" is defined as systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met. DOE maintains strong, continual coordination activities among its science and technology programs to meaningfully integrate the R&D that the Department supports.

At the early stages of energy sector innovation—especially discoveries born through scientific research—the private sector has minimal investments, while the Department supports a wide range of energy technologies through a palette of pre-competitive R&D programs.

Your two assumptions are important factors when the Department considers which, if any, demonstration and deployment activities to support as part of integrated mission-critical programs that span the full range of the R&D spectrum in order to help bring new high-priority energy technologies to the market. Getting the balance right is challenging, but no part of the spectrum can be neglected if new technologies are to be brought from the laboratory bench all the way through to the marketplace, which in some cases includes demonstrating technologies with the objective of encouraging adoption by the private sector.

The merit of each technology for achieving a desired technical change needs to be carefully weighed to justify government funding of the latter stages of innovation. The need for new energy solutions is paramount; however, and the consequences of inaction may be enormous.

QUESTION FROM REPRESENTATIVE JOHNSON

Q1b. Arguments used to oppose investments in applied research on new energy technologies appear to center on the following two assumptions: if it is worth doing, then market forces will drive private sector entities to do it on their own; and, taxpayer investment in technology innovation skews market forces and amounts to the government picking winners and losers. This debate is somewhat confused by the fact that the terms "basic research" and "applied research" have different meanings to different people. Activities that policymakers and agencies consider to be applied research may often be considered by the private sector to be basic research that is far too underdeveloped to warrant significant investment by the private sector.

Will the private sector conduct the type of basic and applied research that DOE provides the nation?

A1b. Basic scientific research typically has little direct commercial return, so its costs are not easily borne by firms. Yet downstream, commercial innovation is dependent on achievements in basic science. Given the importance of basic research, coupled with its low private return, the American innovation system relies on public support of university and government researchers who work to develop scientific breakthroughs and make these breakthroughs publicly available.

As described in the *Science for Energy Technology – Strengthening the Link between Basic Research and Industry* report, which was commissioned by the Basic Energy Sciences Advisory Committee, private firms ultimately commercialize clean energy technology and therefore creates jobs. DOE serves a unique role in providing support for basic and applied research aimed toward scientific breakthroughs in knowledge with broad public benefit spillovers that are not easily appropriable by private firms. Improved understanding enables and accelerates firms' development and commercialization activities by revealing the underlying principles controlling clean energy phenomena and also revealing opportunities for translating this knowledge to commercial applications.

QUESTION FROM REPRESENTATIVE JOHNSON

Q1c. Arguments used to oppose investments in applied research on new energy technologies appear to center on the following two assumptions: if it is worth doing, then market forces will drive private sector entities to do it on their own; and, taxpayer investment in technology innovation skews market forces and amounts to the government picking winners and losers. This debate is somewhat confused by the fact that the terms "basic research" and "applied research" have different meanings to different people. Activities that policymakers and agencies consider to be applied research may often be considered by the private sector to be basic research that is far too underdeveloped to warrant significant investment by the private sector.

What would be the likely effect in this sector if you took DOE's contribution out of the mix?

A1c. If DOE's energy R&D contributions ceased, the immediate effect would be the termination of numerous research projects at universities and national laboratories across the country, including the loss of thousands of jobs. Such mass terminations could cause a shift of researchers and students away from disciplines related to advancements in energy sector innovations. In turn, these shifts could severely degrade the Nation's ability to compete with other countries for the human capital required to achieve the innovations to drive a 21st century clean energy economy.

QUESTION FROM REPRESENTATIVE JOHNSON

Q1d. Arguments used to oppose investments in applied research on new energy technologies appear to center on the following two assumptions: if it is worth doing, then market forces will drive private sector entities to do it on their own; and, taxpayer investment in technology innovation skews market forces and amounts to the government picking winners and losers. This debate is somewhat confused by the fact that the terms "basic research" and "applied research" have different meanings to different people. Activities that policymakers and agencies consider to be applied research may often be considered by the private sector to be basic research that is far too underdeveloped to warrant significant investment by the private sector.

If you were to remove all research that may have potential market value from DOE's research portfolio, what would that leave?

A1d. Nearly all aspects of DOE's research portfolio have potential near- to long-term market value. Removing such research will cripple the base of the Department's research and development efforts and significantly damage the agency's ability to fulfill its missions in energy, environment and national security.

QUESTION FROM REPRESENTATIVE JOHNSON

Q1e. Arguments used to oppose investment in applied research on new energy technologies appear to center on the following two assumptions: if it is worth doing, then market forces will drive private sector entities to do it on their own; and, taxpayer investment in technology innovation skews market forces and amounts to the government picking winners and losers. This debate is somewhat confused by the fact that the terms "basic research" and "applied research" have different meanings to different people. Activities that policy makers and agencies consider to be applied research may often be considered by the private sector to be basic research that is far too underdeveloped to warrant significant investment by the private sector.

Do programs such as ARPA-E and offices such as EERE crowd out private investment or otherwise negatively skew the marketplace by investing in projects that may have a potential commercial application or previous private sector investment?

A1e. Programs such as ARPA-E and offices such as EERE do not crowd out private investment or negatively skew the marketplace. Private capital generally undertakes projects with minimal technical risk. It is extremely rare for private capital to finance projects that have high technical risk and high market risk. Public investment allows for appropriate maturation of the technologies, effectively de-risking them, which stimulates private investment for technology scale-up and manufacturing. ARPA-E, through expertise of its own staff, and the access it has to the full technical expertise of the Department and its labs, is strongly positioned to carry out technical vetting of high risk technology ideas.

Six projects funded by ARPA-E, at a level of $24 million in 2010, have received over $100 million in private sector follow on funding. ARPA-E's initial funding allowed these innovators to do the research and overcome some technical barriers, ahead of schedule. The follow-on funding likely would have not arrived without ARPA-E's initial investment. Overall, ARPA-E projects have garnered over $260 million in such follow-on funding. In addition, ARPA-E projects have filed 17 patents already.

EERE's strategic investments in clean energy technologies have also yielded significant results. For example, the Solar Energy Technology Program has invested $59 million of aggregated Photovoltaic Technology Incubator funds since 2007, successfully leveraging over $1.2 billion in private capital – a 20 to 1 leverage of taxpayer dollars – and creating over 1,100 jobs in the United States. Other EERE programs have also attracted significant private capital investments. The Biomass Program invested $1billion to support 29 integrated biorefineries which was matched by $1.7 billion in private investment. These Federal investments represent a portfolio approach to maturing a wide variety of technologies at various stages of development – R&D, pilot, demonstration, and commercial scale – that have strong promise to help continue the growth of domestic clean energy markets.

Additionally, $480 million in EERE competitive energy efficiency grants are expected to have an average of 67% cost share and be matched with over $970 million in private investment while $252 million in grants for industrial energy efficiency will have over a 76% private cost share which will raise $821 million private funds.

QUESTION FROM REPRESENTATIVE JOHNSON

Q1f. Arguments used to oppose investments in applied research on new energy technologies appear to center on the following two assumptions: if it is worth doing, then market forces will drive private sector entities to do it on their own; and, taxpayer investment in technology innovation skews market forces and amounts to the government picking winners and losers. This debate is somewhat confused by the fact that the terms "basic research" and "applied research" have different meanings to different people. Activities that policymakers and agencies consider to be applied research may often be considered by the private sector to be basic research that is far too undeveloped to warrant significant investment by the private sector.

In terms of the ability for private entities to do the research necessary to push energy innovations into the marketplace, compare and contrast the work conducted in EERE or ARPA-E with that of Nuclear or Fossil Energy?

A1f. The Department of Energy's (DOE) technology programs, focusing on issues from energy efficiency to nuclear power generation, work to create options for new technologies to enter the market by addressing relevant risks and informing regulatory policy. Because industry, market, and regulatory risk are often related to the scale of a technology and the associated capital cost, the functions of the DOE technology programs are tuned to the most relevant needs of their corresponding markets. For example, efficiency improvements in relatively inexpensive consumer products with frequent turnover require far less technical and regulatory certainty to enter a market than does the capture and sequestration of carbon from multi-billion dollar fossil power generation facilities that last a half-century or more.

With regards to ARPA-E, the work done in that DOE office is focused on game-changing breakthroughs in technology. Using an entrepreneurial funding model, ARPA-E hunts for and funds new technologies where a short-term R&D effort could deliver game-changing results. ARPA-E is a small, risk-tolerant organization with a singular mission – to accelerate transformational technological advances in areas that the private sector by itself is unwilling to undertake because of technical or financial uncertainty. ARPA-E is not envisioned as supporting the work necessary to scale-up promising new technologies; rather, it seeks to fund those technologies that do not yet exist.

Because the market failures that prevent the modernization and transformation of our energy sectors are different for each technology, each DOE program (from ARPA-E through Nuclear Energy) is responsible for addressing a unique and technology relevant set of risks and market failures. The Department's role is not to duplicate activities already ongoing in the marketplace, but rather address the technology, regulatory, and other risks which limit the adoption of the new technologies necessary to achieve our energy, security, economic, and environmental goals.

QUESTION FROM REPRESENTATIVE JOHNSON

Q2a. The Biological and Environmental Research (BER) program has been highlighted by some Republicans as conducting duplicative research that is ancillary to the Departments mission. During House consideration of H.R.1 in February, an amendment was offered to zero-out funding for the BER program.

How is "Biological and Environmental Research (BER)" relevant to energy, and why should DOE be involved?

A2a. The BER program supports a unique portfolio of forefront, multidisciplinary systems biology research aimed at harnessing the capabilities of plants and microbes for energy and environmental solutions, while driving the development of new enabling tools that broadly impact biotechnology in the U.S. Combined with the program's successful track record of bringing together small and large multidisciplinary teams from national laboratories and universities to tackle complex problems, the BER program is especially well positioned to address some of the long-standing grand challenges in the development of advanced biofuels. Biofuels are a critical component of a sustainable energy future, requiring innovative research strategies to support aggressive biofuels production goals and help reduce our nation's dependence on imported oil. The BER genomic sciences research and the Joint Genome Institute (JGI), a user facility that sequences over four trillion genome base pairs per year, are using contemporary systems biology for energy-relevant missions such as the development of cost-effective cellulosic biofuels. The three Bioenergy Research Centers devoted to fundamental research related to new concepts and processes for biofuels production from inedible plant fibers are part of this program. The JGI is the only scientific user facility in the world dedicated to sequencing and analyzing whole genomes of energy- and environmentally-relevant microbes and plants. BER leads the world in the sequencing, study, and reengineering of microorganisms and plants with direct relevance to energy, and is unique in the federal government in supporting this work through an integrated systems-level study—from genome to function.

BER research underpins DOE mission needs for energy production and use. Because there is not sufficient assurance for near term profits from fundamental research, the private sector does not generally support this phase of research. Fundamental research on microbes and plants to understand their biochemical pathways and the genetic mechanisms that control their interactions and behavior provides knowledge needed by DOE's Office of Energy Efficiency and Renewable Energy (EERE) for development of systems for conversion of biomass to biofuels that can be commercialized.

Likewise, understanding how and why the Earth's climate will change in the future, as a result of changes in atmospheric, terrestrial, ocean, and cryospheric conditions, will enable informed decisions about future energy technology development and deployment investments, management of natural resources, and assessing national security vulnerabilities. To support the DOE energy mission, climate prediction tools are required to make projections of future changes in wind, temperature, and precipitation patterns (and extremes) at sufficiently high resolution that the design, deployment, financing, and siting of future infrastructures are based on the best possible information. In building its prediction capability to serve these requirements, BER focuses its basic science investments on topics that are in most part unique to DOE, such as atmospheric cloud and aerosol science and experimental field facilities; dynamical interactions between ecosystems and greenhouse gases; and analysis of impacts of climatic change on energy production and use. Through DOE participation in the USGCRP, BER assimilates research outputs from other agencies (such as hurricane research at NOAA and NSF, hydrology research at USGS, and agricultural research at USDA) so that the BER climate predictions are able to contribute to the most advanced products possible. The Department's mission is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. In order for the mission to be sustained, DOE must make science and technology investments that advance the efficiency, affordability, and minimal deployment risk of all possible energy technology sectors, that can be adopted into future national energy infrastructures and project the U.S. on a path towards energy independence. While scientific investments that advance energy technologies rely on discoveries in material, biological, and chemical sciences, parallel scientific research that minimizes design and deployment risk requires accurate descriptions of long-term weather patterns and extremes over infrastructure lifetimes. Extremes include, for example, frequency of occurrence of hurricanes, flood, drought, heat waves, etc. How these events might change and in turn impact growing bioenergy crops and/or siting of wind energy farms is a risk the DOE and industries need to examine the modeling and prediction tools developed by DOE are based in most part on BER-supported science, and the DOE participation in USGCRP allows science developed by other agencies (including NOAA, USDA, USGS, NSF, and NASA) to be rapidly assimilated into our prediction capabilities. It is both the uniqueness and mission-value of the BER science as well as the USGCRP framework that allows rapid assimilation of other agency research products that has resulted in BER preeminence and best-in-class stature in climate prediction capabilities. With this approach, these capabilities are also serving to contribute to the energy component of the Nation's strategic economic security.

QUESTION FROM REPRESENTATIVE JOHNSON

Q2b. The Biological and Environmental Research (BER) program has been highlighted by some Republicans as conducting duplicative research that is ancillary to the Departments mission. During House consideration of H.R.1 in February, an amendment was offered to zero-out funding for the BER program.

Why is this program important and can you give the Committee some examples of the program's successes?

A2b. Biofuels are a critical component of a sustainable energy future, requiring innovative research strategies to support aggressive alternative biofuels production goals and help reduce our nation's dependence on imported oil. BER underpins the development of biotechnology solutions for biofuel production, through a unique combination of systems biology research on plants and microbes at universities and DOE national labs—including the Bioenergy Research Centers—and national scientific user facilities.

Because there is not sufficient assurance for near term profits from fundamental research, the private sector does not generally support this phase of research. BER has a strong track record in tackling large, complex scientific challenges, and the BER program is uniquely positioned in the federal government to address some of the long-standing grand challenges associated with the development of advanced biofuels.

In the area of climate and environmental research, the predecessors of the BER program within DOE initiated the development of what became the first global circulation models, which enabled the prediction of the behavior of radioactive fallout. From these beginnings came the development of today's sophisticated climate models needed to understand and predict potential climate changes from decades to centuries in advance—information needed to plan for future energy use, land use, food production, and water resources and to help mitigate economic and financial risks in infrastructure planning. Such information is invaluable at a time when regional stability and geopolitical issues are so critical to our national security concerns. In response to stakeholder needs, the spatial and temporal resolution of climate models has increased over time and with increasing performance requirements. BER has played a lead role in developing the necessary fundamental science and spearheading the development of these models to address national challenges. BER has a unique and targeted portfolio of research and research capabilities not supported by other agencies. Likewise the atmospheric observational capabilities and data produced from the BER program are broadly used by climate researchers supported by other federal agencies.

Some BER program highlights and successes include:

- **DOE Bioenergy Research Centers** use cutting-edge basic research approaches to develop genomics-based biological solutions to critical cellulosic biofuel bottlenecks. These solutions can be leveraged by the applied research programs in EERE and complement other direct fuels work in ARPA-E.
    - **Revolutionary pretreatment process.** Development of room-temperature ionic liquids as a new method of biomass pretreatment, cutting processing times by a factor of 60 and rendering biomass far more accessible to enzymatic breakdown.
    - **Hydrocarbons from microbes.** Reengineering microbes to produce not just ethanol but higher energy hydrocarbon fuels, including a microbe that converts switchgrass directly to biodiesel.

  - **Improving Feedstocks.** Identification of a gene in switchgrass that causes the grass to produce less lignin while remaining robust in the field—cutting costs of processing and increasing biofuel yields. Redesign of plant biomass lignins to facilitate processing and increase biofuel yields.

  - **Strengthening Microbes.** Development of new strains of ethanol-producing microbes with enhanced tolerance to stresses associated with industrial biofuels production.

  - **Sustainable Biofuels Production.** Cutting-edge research on biofuels sustainability including demonstrating the impacts of biomass crop agriculture on marginal lands through increased diversity in soil microbial communities and potential for changes in greenhouse gas emissions

- **Joint Genome Institute**

  - **Initiated the genomics revolution.** With its foundation of big team, technology dependent, computationally intensive science, BER initiated the Human Genome Project in the 1990s that led to the technology development and knowledge base that today underpins unparalleled advances in medicine, agriculture and energy.

  - **Determined genomic sequence of the first woody plant and key bioenergy feedstocks.** The first tree ever sequenced was the black cottonwood, *Populus trichocarpa,* which is the largest hardwood tree in western North America; the 500Mb genome includes a significant duplication of 8000 gene pairs. Since forests represent 90% of terrestrial biomass, access to genome-based traits in woody biomass is relevant to DOE bioenergy and carbon sequestration missions. Other bioenergy plants sequenced include Brachypodium (a model plant for grasses) and sorghum, whose 700Mb genome was the largest sequenced to date using the whole genome shotgun method. Information from the sorghum genome will be useful in identifying key traits that allow this perennial grass to grow on marginal soil underpinning development of improved feedstocks for bioenergy.

  - **Revolutionized genomic sequencing of complex microbial communities.** The JGI has pioneered genome sequencing of entire communities of microbes from their natural environments, accelerating discovery in comparison to standard genome sequencing of isolated and culturable single microbes. Genomic sequencing of the community of microbes in the termite hindgut provides novel insights into one of Earth's most efficient wood degraders, offering biology-based solutions to an outstanding challenge in the production of biofuels, breakdown of woody biomass.

- **Atmospheric Radiation Measurement Climate Research Facility (ARM)**

  - **Long-term observations address greatest uncertainty in climate change – clouds and aerosols.** ARM provides cutting-edge cloud, aerosol and now precipitation observations for determining their role on the climate system. During the past decade, the ARM has reduced the uncertainty of the local column radiative balance from nearly 10 Watt/m2 to below 2 Watts/m2, thus allowing scientists to constrain parameterizations of cloud and aerosol interactions; these successes have also helped guide a NASA mission designed to monitor clouds, aerosols, and radiative transfer. Similarly, the ARM data bases have been the most important reason for improvements in the atmospheric component of the DOE earth system (climate) model to become "best in class", that in turn has provided revolutionary new approaches to climate prediction.

  - **ARM Mobile facilities quantify the impact of aerosols.** The ARM mobile facility has been deployed to examine the impact of aerosols on the radiation budget in diverse climatic regions. It has been used to: track how soot particles age in biomass plumes from California; provide the data needed to model both Arctic and high-altitude ice clouds; study impacts of aerosols on clouds and precipitation in the tropics; and evaluate the potential impacts of Saharan dust on hurricane development.

- **Climate Modeling**
  - **High-resolution model improves regional climate projection and uncertainty analysis.** BER led the development of the Community Earth System Model, including the capability for very high resolution modeling that leverages the DOE Leadership Computing facilities. This model provides a critical capacity for regional climate projections, including information on how the frequency of occurrence and intensity of storms, droughts, and heat waves will change as climate evolves.

  - **New modeling capability for abrupt climate change, including sea level rise.** BER led the development of the world's best models for sea- and land-ice. Implemented within the Community Earth System Model, these components will guide projections for the timing of an ice-free Arctic and evaluate factors that may cause the destabilization of Greenland and Antarctic ice sheets leading to significant sea level rise.

  - **Understanding the uncertainties in climate**. BER scientists at universities and the Program for Climate Model Diagnosis and Intercomparison (PCMDI) at Lawrence Livermore National Laboratory develop critical metrics for the objective evaluation of climate model simulations. This diagnostic capability is vital to the evaluation of model biases, uncertainties and the eventual improvement of all climate models.

- **Environmental Molecular Sciences Laboratory**
  - **Improving the long-term performance of lithium ion batteries.** EMSL provides a variety of advanced microscopy capabilities to study the interfaces of natural and engineered materials for energy storage. EMSL scientists teamed with scientists from DOE's Center for Integrated Nanotechnologies creating a nano-sized battery to show how such batteries wear out over time.

  - **Predicting the movement of contaminants in ground water and soils.** Using sophisticated microfluids and high performance computing, EMSL users were able to model movement of contaminants in the subsurface, results that could lead to new clean up and monitoring strategies relevant to clean up of legacy contamination at DOE sites.

  - **New catalysts for producing renewable energy.** Using EMSL's advanced imaging and computational capabilities, EMSL users developed a new understanding of the use of titanium dioxide as a catalyst, improving our ability to efficiently produce hydrogen as a renewable fuel.

QUESTION FROM REPRESENTATIVE JOHNSON

Q2c. The Biological and Environmental Research (BER) program has been highlighted by some Republicans as conducting duplicative research that is ancillary to the Departments mission. During House consideration of H.R.1 in February, an amendment was offered to zero-out funding for the BER program.

What would the effect be of zero-ing out BER?

A2c. DOE's BER is unique in bringing together *multi-disciplinary research and resources* that span subcellular to ecosystem scales, focused on *DOE mission goals* of bioenergy, carbon cycling and climate science, and environmental stewardship. BER also has a long history in driving biotechnology revolutions through research that merges the physical and biological sciences. Because there is not sufficient assurance for near term profits from fundamental research, the private sector does not generally support this phase of research. Zero-ing out BER would result in a reduction of capability and knowledge relevant to achieving these important national goals. The nearer-term effect would be a deceleration of advancements in bioenergy innovations and a decline of our nation's leadership in biotechnology. The longer-term effect would be that critically needed bioenergy discoveries and climate science expertise would no longer be available to help achieve our energy independence and environmental stewardship goals.

QUESTION FROM REPRESENTATIVE JOHNSON

Q3a. Recent proposals to slash funding for both basic and applied research programs at DOE highlight what appears to be a dangerous and growing sentiment that R&D programs amount to wasteful spending and are not a wise investment in our future.

How would you counter that assertion?

A3a. Scientific research is at the core of a high-tech economy and integrates knowledge of natural processes in ways that are directly useable for practical engineering applications. Basic researchers develop new tools and techniques that allow us to discover and measure previously inaccessible physical phenomena, which form the basis of new technologies or solutions to long-standing technical barriers. Scientific understanding is most practical when it solves problems that arise in the design, manufacture or operations of complex technologies. Finally, research is a prime training ground for a technically talented workforce that can drive future innovation, representing a worthwhile investment in our future global competitiveness.

QUESTION FROM REPRESENTATIVE JOHNSON

Q3b. Recent proposals to slash funding for both basic and applied research programs at DOE highlight what appears to be a dangerous and growing sentiment that R&D programs amount to wasteful spending and are not a wise investment in our future.

What is the likely short-term impact to DOE's research enterprise (labs, university researchers, students, etc) if such cuts are made?

A3b. Short-term impacts would include termination of most fundamental research activities in bioenergy, environment, and climate, including university grants, laboratory programs, scientific user facilities, contracts for instrumentation, contracts for other goods and services. The negative impact would also extend to the work-for-others (other federal agencies or private industry) performed by scientists at DOE national laboratories due to their unique research expertise. It would likely also damage the ability of universities to attract and retain students in these critically important fields.

QUESTION FROM REPRESENTATIVE JOHNSON

Q3c. Recent proposals to slash funding for both basic and applied research programs at DOE highlight what appears to be a dangerous and growing sentiment that R&D programs amount to wasteful spending and are not a wise investment in our future.

What is the likely long-term impact on our economic competitiveness?

A3c. In February, the Administration issued an updated edition of the 2009 white paper, A Strategy for American Innovation, reaffirming commitment to accelerate research, development, and deployment of clean energy technologies, to shift the American economy toward global leadership and a clean, secure, and independent energy future. Materials science, biology, and chemistry have all benefited from a revolution in instrumentation and computation, and the time is right to seize the opportunity provided by this new generation of tools to push toward a level of systematization that will allow much more rapid achievement of results. The goal is to move these fields from empirical, trial-and-error approaches toward achievement of results through rational design, ultimately computer-aided design, to achieve more rapid progress in overcoming technological barriers to a new energy economy. The long-term impact on significantly reducing funding for BER and basic research and development may be a loss of American leadership and competitiveness in the global energy economy. Likewise, industries from automobile manufactures, to pharmaceutical and biotech companies, to information technology companies unable to advance the scientific discoveries from federally-funded fundamental research into new technology concepts, or unable to advance their own R&D through use of the DOE Office of Science scientific user facilities will find themselves less able to compete in the global marketplace.

QUESTION FROM REPRESENTATIVE MILLER

Q1a. During the development of legislation authorizing ARPA-E, and in the time since, this Committee heard concerns that it would drain the attention and resources from the Office of Science. Furthermore, it was said that ARPA-E would duplicate the work of the existing research programs. Proponents of ARPA-E contend that it works in the technology "white spaces" that other programs tend to ignore, and that investment in the program should occur within the context of strategic resources for a wide range of energy innovation efforts at DOE, from basic to applied research, and beyond.

Is ARPA-E draining resources from the Office of Science? Is this a zero sum game?

A1a. No. Programs within the Department of Energy are designed to work in concert in order to succeed. The Office of Science and ARPA-E are pursuing complementary aims – the Office of Science funds basic science research, which can potentially be translated into breakthrough energy technologies by ARPA-E, other DOE programs, or industry. For example, the Office of Science focuses on understanding the basic principles of magnetism, charge transport, and electrostatics of solids (metals, semiconductors, insulators), and ARPA-E projects might translate those research results into creating new high-frequency power electronic devices and systems based on integrating wide-bandgap semiconductors (GaN, SiC) and nanostructured magnetics for LED, PV, electric vehicles and grid markets. The Office of Science's FY2010 funding totaled $4,963,887,000 and the President's Budget requested $5,121,437,000 for FY2011 and $5,416,414,000 for FY2012 – an incremental increase in funding each year for that program. ARPA-E's focus areas and funding request remain distinct.

QUESTION FROM REPRESENTATIVE MILLER

Q1b. During the development of legislation authorizing ARPA-E, and in the time since, this Committee heard concerns that it would drain the attention and resources from the Office of Science. Furthermore, it was said that ARPA-E would duplicate the work of the existing research programs. Proponents of ARPA-E contend that it works in the technology "white spaces" that other programs tend to ignore, and that investment in the program should occur within the context of strategic resources for a wide range of energy innovation efforts at DOE, from basic to applied research, and beyond.

How is ARPA-E different and not duplicative of other programs?

A1b. ARPA-E's mission is to aid the development of transformational energy technologies – technologies that hold the potential to radically shift the nation's energy reality. ARPA-E occupies a position in the technology development space not occupied by other DOE programs. ARPA-E funds early-stage energy technologies when they are considered too high-risk (both technical risk and market risk) to attract investment from other government agencies and private investors. Whereas the applied programs focus primarily on taking technologies down their economic learning curves, ARPA-E focuses on creating entirely new learning curves through transformative and disruptive new technologies. ARPA-E focuses on transferring science into breakthrough technologies.

For example, with regard to batteries, the Office of Science focuses on understanding the electrochemistry of metal-oxygen reactions as well as lithium reactions and transport in variety of intercalation compounds. The DOE applied energy programs focus on improving the efficiency of lithium-ion batteries via different configurations and materials for cathodes, anodes, separators, electrolytes for automobile market. ARPA-E projects are researching new metal-air (lithium-air, zinc-air, etc.) battery devices and systems for the automobile market that, if the projects are successful, could be ten times better in cost-performance metrics than the lithium-ion batteries of today's vehicles.

ARPA-E takes great care to ensure that its projects do not overlap with other DOE programs, but instead complements them in multiple ways. The program works in close coordination with program offices on its "borders" – DOE's basic science and applied research programs – to avoid duplicative research and ensure a balanced research portfolio across the DOE. Moreover, all parts of DOE work in collaboration to identify gaps in their research portfolios ("white space") as well as through co-hosting topical workshops in the development of programs. This coordination also serves to inform all parties of each other's ongoing research activities to facilitate the transition of successful ARPA-E projects to other DOE programs.

Before issuing a funding opportunity announcement on a particular technology area, ARPA-E studies the technology area in depth. ARPA-E consults closely with other DOE offices and programs to avoid any duplication or redundancy. ARPA-E engages members of other DOE offices in ARPA-E workshops, defining the funding opportunity announcements, and proposal review process.

To improve coordination within DOE, ARPA-E has formed a Panel of Senior Technical Advisors (PASTA). PASTA consists of Assistant Secretaries (or their Technical Appointees) of all the relevant applied energy offices as well as the heads of all the relevant offices in the Office of Science. The purpose of PASTA is to coordinate and leverage each of its programs and also to ensure that ARPA-E provides unique value within the DOE. In addition, the Director of ARPA-E actively coordinates with the Director of the Office of Science as well as the Under Secretaries for Energy and Science.

QUESTION FROM REPRESENTATIVE MILLER

Q1c. During the development of legislation authorizing ARPA-E, and in the time since, this Committee heard concerns that it would drain the attention and resources from the Office of Science. Furthermore, it was said that ARPA-E would duplicate the work of the existing research programs. Proponents of ARPA-E contend that it works in the technology "white spaces" that other programs tend to ignore, and that investment in the program should occur within the context of strategic resources for a wide range of energy innovation efforts at DOE, from basic to applied research, and beyond.

What will be the role of ARPA-E in the partnership between the DOE and DOD?

A1c. Under the auspices of the Department of Energy (DOE)-Department of Defense (DoD) Memorandum of Understanding, ARPA-E has been actively working with the DoD to provide it with next-generation and critical energy capabilities. Presently, ARPA-E has identified the following specific opportunities:

1. ARPA-E and DoD Science & Technology organizations plan to establish joint programs to leverage common interest in energy technology development that would have long-term benefit to both commercial and defense markets. ARPA-E and the Assistant Secretary of Defense for Research and Engineering are presently establishing the framework of one such program that will lead to the development of a hybrid energy storage module.

2. ARPA-E establishes and funds programs with both commercial and defense needs. Subsequent to the maturation of the technology, the DoD provides funding for scale-up and domestic manufacturing of the technology. Presently, the Navy is conducting diligence to determine the viability of ARPA-E's Electrofuels

Program (the creation of a non-photosynthetic mechanism to develop fuel) and whether it has the potential to meet Navy's fuel requirements.

In addition, ARPA-E will raise other opportunities with DOD as they are identified. ARPA-E considers itself privileged to be working with the DoD and is very interested in providing the DoD energy technologies that would enable it to meet its goals, thereby increasing the energy and national security of the United States.

QUESTION FROM REPRESENTATIVE MILLER

Q2a. As you know, EPA and the National Highway Transit Safety Administration (NHTSA) have proposed Greenhouse Gas and Fuel Efficiency regulations for Heavy Duty trucks and buses. These are expected to be finalized this summer and will begin to go into effect in 2014 with another round going into effect in 2017.

Do you see DOE having any role in providing the R&D that will demonstrate/establish what is technologically feasible in the area of fuel efficiency and emissions in Heavy Duty trucks?

A2a. The Department works closely with EPA and NHTSA, keeping both agencies apprised of research and development progress, as well as the current status of new vehicles technologies, with a focus on cost and efficiency targets. This information helps to inform their rulemaking process.

QUESTION FROM REPRESENTATIVE MILLER

Q2b. As you know, EPA and the National Highway Transit Safety Administration (NHTSA) have proposed Greenhouse Gas and Fuel Efficiency regulations for Heavy Duty trucks and buses. These are expected to be finalized this summer and will begin to go into effect in 2014 with another round going into effect in 2017

If so, will this current budget support DOE collaborating with EPA and NHTSA in establishing these standards?

A2b. The fiscal year 2012 budget request supports the Department's continued collaboration with EPA and NHTSA, which occurs primarily through regular interaction among key technical staff in all three agencies.

QUESTION FROM REPRESENTATIVE SEWELL

Q2. What considerations were taken into account when requesting funds for research and development concerning these energy sources, particularly clean coal technology?

A2. The Office of Fossil Energy's research and development (R&D) program supports the U.S. Department of Energy's (DOE) overall mission to achieve national energy security in an economic and environmentally sound manner. The mission of the FER&D program is to create technology and technology-based policy options for public benefit by enhancing U.S. economic, environmental, and energy security. This mission is achieved by developing technologies to enhance the clean use of domestic fossil fuels and to reduce emissions from fossil-fueled electricity generation plants to achieve near-zero atmospheric emissions power production.

Specific to clean coal technology, the current focus of RD&D activities is two-fold:

- Demonstrate the operation of current CCS technologies integrated at an appropriate scale to prove safe and reliable capture and storage.
- Develop improved CO2 capture component technologies and advanced power generation technologies to significantly reduce the cost of CCS, to facilitate widespread cost-effective deployment after 2020.

DOE's efforts are guided by the Secretary of Energy's goal to support RD&D so that widespread cost-effective deployment of CCS can begin in eight to ten years (Chu, 2009). RD&D and learning-by-doing could transform CCS from a technology only affordable to industrialized nations to a cost-effective GHG mitigation option with a

QUESTION FROM REPRESENTATIVE COSTELLO

Q1. Will the proposed decrease in funding for coal R&D impact President Obama's plan to have 10 clean coal demonstration projects online by 2016?

A1. President Obama's stated goal was to have five to ten large-scale, carbon capture and storage (CCS) demonstration projects online by 2016. As you know, the American Recovery and Reinvestment Act (Recovery Act) included significant investments in clean coal technologies. The Department of Energy is currently supporting the development of nine large-scale CCS demonstration projects through FutureGen 2.0, the Clean Coal Power Initiative, and the Industrial Carbon Capture and Storage program. The timelines for these projects should result in them being operational by 2016. These first-generation CCS demonstration projects are supported by prior appropriations, including those from the Recovery Act, and do not rely on outyear DOE funds. The decrease in funding represents the shift in focus toward technologies that have potential benefits to both existing and new fossil-fueled power plants. In addition, recently obligated Recovery Act funding will ensure that development of gasification technologies and hydrogen turbines will continue to advance on or ahead of schedule. The Department has not requested FY2012 funding for longer-term Solid Oxide Fuel Cells R&D which has been postponed to focus on more near-term CCS technologies.

QUESTION FROM REPRESENTATIVE SEWELL

Q1. How does DOE prioritize coal, other fossil technologies, and nuclear energy in relation to other technologies in the FY 2012 proposed budget?

A1. DOE believes that clean energy and energy security concerns are sufficiently compelling and that those technologies that could make a significant, economically viable contribution to the Nation's portfolio of options should be considered. The questions that DOE particularly focuses on in its budget prioritization deliberations include:

- What technologies can make the greatest potential contributions to the Nation's future energy goals?
- What is the appropriate Federal role, if any, to encourage the development of high priority technologies in a timeframe that is most relevant? It is important to recognize that the level of funding for a technology in a particular year does not necessarily reflect priority. For example, funding for early stage research and development will usually be lower than for technologies in the demonstration stage. Further, in some cases incentives such as loan guarantees may be the most cost-effective strategy (e.g., to encourage construction of new, modern nuclear plants), while direct funding may be the best approach for demonstrating technologies that have no large-scale commercial precedent (e.g., carbon capture and storage).

QUESTION FROM REPRESENTATIVE CLARKE

Q1. DOE's original proposal for a rare isotope beam facility – the Rare Isotope Accelerator – would have cost more than $1 billion in year 2000 dollars. Working together, the Department and the nuclear physics community, including researchers at Michigan State, were able to find efficiencies to significantly reduce the proposed facility's total cost while retaining its world leading research capabilities. Thanks to their efforts, FRIB will cost roughly $615 million, about half as much as the original proposal.

Are you aware of any other DOE facility that has been subjected to the same level of value engineering and budgetary scrutiny?

A1. All DOE Office of Science Projects are carried out following the principles of DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, which subjects them to the same level of value engineering and budgetary scrutiny that was applied to the Facility for Rare Isotope Beams.

QUESTION FROM REPRESENTATIVE CLARKE

Q2. DOE's original proposal for a rare isotope beam facility – the Rare Isotope Accelerator – would have cost more than $1 billion in year 2000 dollars. Working together, the Department and the nuclear physics community, including researchers at Michigan State, were able to find efficiencies to significantly reduce the proposed facility's total cost while retaining its world leading research capabilities. Thanks to their efforts, FRIB will cost roughly $615 million, about half as much as the original proposal.

How can we learn from this effort to keep costs down while continuing to invest in world class research?

A2. Following the principles of DOE Order 413.3B requires that formal milestones called Critical Decisions are achieved as the possible construction of a new facility is pursued. The first of these milestones, CD0, establishes that the new capability that would be provided is critically needed for the mission of the DOE. The second milestone, CD1, requires an alternatives analysis to ensure that the proposed facility provides the most cost effective alternative, including potential partnering and contributions from other institutions. The Facility for Rare Isotope Beams received CD1 in September 2010, at which time the upper limit of the Total Project Cost (TPC) range was estimated to be $614, 500,000, including a cost share of $94,500,000 from Michigan State University. This facility, which will provide world leading capabilities, is reduced in scope from the concept for the Rare Isotope Accelerator (RIA), leaving some elements of the original proposal as possible future science-driven upgrades.

global impact. DOE estimates that for new plants, 2nd generation CO2 capture technologies combined with advanced power generation technologies could limit the increase in COE at the plant gate to 30 percent compared with a modern supercritical PC plant without CCS. For current 1st generation CCS plants, DOE estimates this increase to be 60–80 percent. For CCS retrofits, DOE estimates that the increase in cost could be reduced by two-thirds with 2nd generation technology. Upon successful development at the laboratory through pilot-scale (5-25 MW), the advanced 2nd generation technologies showing the most promise in terms of reducing costs and energy penalties could warrant further development and demonstration at full-scale before commercial acceptance, which may take on the order of a decade. The relative roles of the government and the private sector in these more advanced stages of CCS development and scale-up should be carefully evaluated.

QUESTION FROM REPRESENTATIVE LUJAN

Q1. Technology Transfer: The Department is home to the Nation's National Laboratories, which can serve as an incredible resource both for developing new technologies from which new businesses and new jobs can spring as well as for providing technical assistance to businesses. Yet, listening to small business owners and entrepreneurs leads me to believe that there is room for improvement in the Department's technology transfer activities. For example, very few of the Department's Cooperative Research and Development Agreements (CRADAs), which is a common mechanism for a private entity to work with a National Laboratory to mature a technology, are supported even in part by Department funds. Most are 100% funded by the private entity, which is prohibitively expensive for many small businesses. Furthermore, the private entity is often required to pay out a significant fraction of the cost of the project up front before the work will be allowed to start. This is too prohibitive. I know your Technology Transfer Coordinator has been working with the Technology Transfer Working Group on ways to improve the Department's tech transfer activities. What specific actions do you expect the Department to take in the next year to invigorate its tech transfer activities, and do any of them include dedicating more funds or reducing barriers to small businesses?

A1. The Department's Technology Transfer Coordinator, Karina Edmonds, has found that DOE Labs could do a better job in engaging with small and medium size companies. Dr. Edmonds is working with the Technology Transfer Working Group (TTWG) to identify ways to improve our collaboration with these companies. As a result of those discussions, DOE recently launched an exciting pilot program to reduce transaction costs for small companies and entrepreneurs who want to license National Lab patents and patent applications. Under the "America's Next Top Innovator" program, the DOE Labs will offer domestic start-up companies an exclusive Option Agreement that can lead to a license. Each Option Agreement can include up to three patents provided that the patents are related to one technology from a single Lab. The goal is to reduce all upfront fees for an exclusive Option to $1,000 and reduce execution time by more than half. The Labs will provide a template agreement to anyone interested in participating in the program. The program enables entrepreneurs who are interested in unlicensed DOE intellectual property (IP) to submit a business plan for commercialization to be eligible for the program. If after the option period the company has met agreed upon milestones and wants to pursue a license to further develop and commercialize the technology, the Labs are committed to working with the company on acceptable terms (e.g., equity and royalties. The program was announced on March 29th, 2011 by Secretary Chu and has been well received by multiple stakeholders. The goal is to commercialize as many technologies as possible by drawing a wide range of expertise to review DOE technologies. Along with the program, Secretary Chu announced a 33% reduction in the advance payment requirement for all companies. This reduction will make it easier for small to medium sized companies to compete for the ability to commercialize technology. We are continuing to work with the Chief Financial Officer to identify further reductions and exceptions for small businesses.

QUESTION FROM REPRESENTATIVE LUJAN

Q2. Natural Gas: Secretary Chu, as you may be aware, New Mexico recently experienced record breaking freezing temperatures that caused a significant increase in peak demand for natural gas. The increases in demand lead to a severe disruption in our natural gas distribution system, causing outages across the state. Over 30,000 homes were left without power to heat their homes. Considering this crisis, can you comment on the Department's efforts to support the research and development of natural gas technologies to ensure the overall security of natural gas delivery systems?

A2. Budget discipline necessitates close scrutiny of all programs. After careful review, we determined that industry has the capacity to pursue pipeline infrastructure research.

QUESTION FROM REPRESENTATIVE LUJAN

Q3. STEM Education: Dr. Chu, the recent National Academy of Sciences report Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads makes clear that we must continue our efforts to increase minority participation in STEM.

In 2007, underrepresented minorities comprised 33.2% of the U.S. college age population, and 26.2% of undergraduate enrollment, yet only 17.7% of those were earning science and engineering bachelor's degrees. Can you comment on DOE's plans to develop a diverse pipeline of STEM professionals in the energy sector?

A3. The Department of Energy has numerous programs with a goal of increasing minority participation in STEM. As three examples:

- The Department does significant outreach to minority scientific professional societies, such as the Society for Hispanic Professional Engineers (SHPE) and the American Indian Science and Engineering Society (AISES) through participation at their annual conferences and sponsorship of scholarships and research internships for students. These efforts are paying off as Minority Serving Institutions (MSI's) are becoming more involved in DOE research programs, for example Morgan State (a Historically Black University) becoming part of a HUBZONE project.
- The Department, principally through Office of Science's Workforce Development for Teachers and Scientists program and the Office of Economic Impact and Diversity, sponsor internship programs that place minority students at DOE national laboratories in research positions or at DOE in federal internships positions. Each year, hundreds of minority students take advantage of these internship opportunities and have an opportunity to receive mentorship and experiences that often lead them into STEM careers.

- The Department has pioneered the Faculty and Student Teams (FaST) program that focuses on faculty at Minority Serving Institutions who serve as a bridge between their students and other faculty and the Department. In 2010, DOE sponsored more than 50 FaST teams, which are comprised of a faculty member from an underserved institution and 2-3 students who work on a research team at a DOE national laboratory. This highly successful program is run in cooperation with the National Science Foundation and in 2011, the Environmental Protection Agency has joined with DOE to offer research opportunities to minority faculty and students.

QUESTION FROM REPRESENTATIVE LUJAN

Q4. Nat Labs: In your remarks you highlight the need to accelerate creation of jobs from our R&D investments by increasing the pace of movement from discovery to the marketplace. What is the DOE doing to improve and streamline the mechanisms for technology transfer from the National Laboratories, especially to small entrepreneurial companies? Other than ARPA-E, which has targeted investments in a small number of companies and technologies, what is the DOE strategy to improve its success rate in engaging the private sector in technology transfer earlier in the R&D cycle?

A4. Newly created companies are our best bet for economic growth and job creation. Numerous studies have shown that it is high growth start-ups that create the majority of jobs. In addition to the reforms detailed above, we are studying ways to make our existing SBIR program more effective in helping to commercialize technologies developed by the DOE by following the example of NIST, USDA and other agencies that have linked their SBIR calls to opportunities presented by their existing IP portfolio. We are currently exploring how to implement a pilot of this concept at one of our Labs. The Department is also examining how to implement the Technology Commercialization Fund [EPAct 2005, section 1001(e)] to provide more attention to funding CRADAs. We agree that the odds for successful commercialization are greatly improved when we engage with the private sector as early as possible in the R&D cycle. This is especially relevant for energy innovations where the market pull is typically weak or missing. We are exploring additional contractual mechanisms outside of CRADAs and WFOs, but within our current authority that may enable DOE Labs to leverage our current resources in creating more meaningful partnerships with the private sector. Facilitating multi-party public/private partnership will be a goal of any new agreement.

Appendix II:

ADDITIONAL MATERIAL FOR THE RECORD

SUBMITTED MATERIALS BY RANKING MEMBER JOHNSON

The Washington Post

Rev the scientific engine

Advertisement

By George F. Will
Sunday, January 2, 2011;

New Republican legislators should come down Capitol Hill to the National Museum of American History, which displays a device that in 1849 was granted U.S. patent 6469. It enabled a boat's "draught of water to be readily lessened" so it could "pass over bars, or through shallow water."

The patentee was from Sangamon County, Ill. Across Constitution Avenue, over the Commerce Department's north entrance, are some words of the patentee, Abraham Lincoln:

THE PATENT SYSTEM ADDED

THE FUEL OF INTEREST

TO THE FIRE OF GENIUS

Stoking that fire is, more than ever, a proper federal function, so the legislators should be given some reading matter. One is William Rosen's book "The Most Powerful Idea in the World," a study of the culture of invention. Another is the National Academy of Sciences report "Rising Above the Gathering Storm, Revisited," an addendum to a 2005 report on declining support for science and engineering research.

Such research is what canals and roads once were - a prerequisite for long-term economic vitality. The first Republican president revered Henry Clay, whose "American System" stressed spending on such "internal improvements." Today, the prerequisites for economic dynamism are ideas. Deborah Wince-Smith of the Council on Competitiveness says: "Talent will be the oil of the 21st century." And the talent that matters most is the cream of the elite. The late Nobel laureate Julius Axelrod said, "Ninety-nine percent of the discoveries are made by 1 percent of the scientists."

With populism rampant, this is not a propitious moment to defend elites, even scientific ones. Nevertheless, the nation depends on nourishing them and the institutions that sustain them.

U.S. undergraduate institutions award 16 percent of their degrees in the natural sciences or engineering; South Korea and China award 38 percent and 47 percent, respectively. America ranks 27th among developed nations in the proportion of students receiving undergraduate degrees in science or engineering.

America has been consuming its seed corn: From 1970 to 1995, federal support for research in the physical sciences, as a fraction of gross domestic product, declined 54 percent; in engineering, 51 percent. On a per-student basis, state support of public universities has declined for more than two decades and was at the lowest level in a quarter-century *before* the current economic unpleasantness.

Annual federal spending on mathematics, the physical sciences and engineering now equals only the *increase* in health-care costs *every nine weeks*.

Republicans are rightly determined to be economizers. They must, however, make distinctions. Congressional conservatives can demonstrate that skill by defending research spending that sustains collaboration among complex institutions - corporations' research entities and research universities. Research, including in the biological sciences, that yields epoch-making advances requires time horizons that often are impossible for businesses, with their inescapable attention to quarterly results.

An iconic conservative understood this. Margaret Thatcher, who studied chemistry as an Oxford undergraduate, said:

"Although basic science can have colossal economic rewards, they are totally unpredictable. And therefore the rewards cannot be judged by immediate results. Nevertheless, the value of [Michael] Faraday's work today must be higher than the capitalization of all shares on the stock exchange."

The last Congress's misbegotten stimulus legislation - an indulgent and incoherent jumble of pent-up political appetites - may have done large and lasting damage by provoking a comparably indiscriminate reaction against federal spending. This will be doubly dangerous if a curdled populism, eager to humble elites, targets a sphere of American supremacy and a basis of its revival - its premier research universities. "Gathering Storm" says that because of the recent recession, many universities - during 2008 and 2009, endowments of public and private institutions declined an average of 18.7 percent - "are in greater jeopardy than at any time in nearly a century."

Granted, political correctness and academic obscurantism in some disciplines - mostly the humanities and social sciences - of some elite universities have damaged the prestige of the institutions and irritated substantial portions of the public. But the public should not now be punished by penalizing, with diminished funding, the scientific disciplines that have been mostly innocent of the behaviors that have sometimes made academia a subject of satire.

Richard Levin, economist and Yale's president, asks: Would Japan's growth have lagged since 1990 "if Microsoft, Netscape, Apple and Google had been Japanese companies"? Japan's failure has been a failure to innovate. As "Gathering Storm" says: Making the government lean by cutting the most defensible - because most productive - federal spending is akin to making an overweight aircraft flight-worthy by removing an engine.

GOP Budget Torches America's 'Seed Corn'

- By Morton M. Kondracke
- Roll Call Executive Editor
- March 3, 2011, Midnight

Tea party torch carriers and the Republican leaders who won't stand up to them are threatening to burn America's seed corn. It's simple-minded madness.

The seed corn is federally funded basic scientific research that produces the discoveries and trains the scientists that eventually create millions of skilled jobs.

But heedless of the consequences, the House Republicans' fiscal 2011 spending bill, H.R. 1, slashes funding for federal scientific research and agencies by as much as 33 percent, threatening to furlough thousands of top scientists, stop their work and force corporations using them to conduct their projects overseas.

This at a time when report after blue-ribbon, business-backed report has warned that the United States is falling seriously behind its competitors in investment in research and science education.

It's bad enough that the GOP is trying to restore its frayed reputation for fiscal responsibility by hacking at domestic discretionary spending — about 16 percent of the federal budget — but it's taking a meat ax to research, which amounts to about 0.04 percent of all spending but pays huge long-run dividends.

Specifically, the bill calls for an $886 million cut for the Department of Energy's Office of Science — an 18 percent reduction from 2010 levels but 33 percent if applied to the seven months remaining in the fiscal year.

Republicans evidently intend to thwart climate control research, but the Office of Science also oversees America's seven national laboratories, which do some of America's most advanced work in nuclear physics, super-computers, new-materials science and nanotechnology.

The bill actually eliminates all funding for the newest U.S. research project, the Advanced Research Projects Agency -Energy, which is dedicated to finding the 21st-century equivalent of lasers and the Internet, discovered by the Defense Advanced Research Projects Agency.

Whether or not Republicans believe that global warming is a real threat, their actions will torpedo research designed to make U.S. energy use more efficient — even facilitating cheaper oil refining — to limit use of imported energy.

H.R. 1 also cuts the National Science Foundation — the source of funding for most "hard science" university research — by nearly 9 percent for the rest of the year, and it clobbers its program for training math and science teachers by 28 percent.

Porter invited five pharmaceutical company CEOs and five Nobel laureates to visit then-Speaker Newt Gingrich (R-Ga.), who got the point and helped Porter, NIH's chief appropriator, increase the agency's budget.

The question this year is: Who's Newt? Who's John Porter? Somebody has got to save America's seed corn from a mindless mob. So far, it's

SUBMITTED STATEMENT BY REPRESENTATIVE JERRY COSTELLO

Mr. Chairman, thank you for holding today's hearing on the Department of Energy's (DOE's) Fiscal Year 2012 (FY12) research and development budget request.

The DOE's FY12 budget requests $29.5 billion, an 11.8% increase over the enacted Fiscal Year 2010 levels. One-third of this funding is requested for R&D programs across the department to develop, demonstrate, and deploy new energy technology. While I have concerns about some proposed cuts, overall this budget will keep the U.S. on a path to achieving energy independence and maintain our leadership in energy innovation.

First, I am pleased to see DOE's expansion of the Energy Innovation Hubs to pursue energy research from its earliest stages to commercial deployment. The FY12 budget would add a new Batteries and Energy Storage Hub, which will build on the remarkable energy storage work done by Argonne National Laboratory in Illinois. The development of new energy storage is critical to improving the efficiency of our vehicle fleet, buildings, and national grid. This new investment, combined with a substantial increase in funding for the Energy Storage subprogram, will ensure we continue to lead the world in the development of energy storage technology.

Second, DOE's budget provides nearly $1 billion in new funding for the Office of Energy Efficiency and Renewable Energy. In particular, the FY12 budget provides $340 million, a 56% increase, for the ongoing development and deployment of cost effective and high-performance biomass fuels, including $150 million for new cellulosic ethanol demonstration projects. This funding reflects a shift in DOE's focus from integrated biorefinery projects and feedstock production trials to larger-scale demonstration projects and commercial deployment. Improving and expanding the use of biofuels will reduce our dependence on foreign oil, lower our emissions, and create millions of American jobs. I am interested in hearing from Dr. Chu what impact these changes in funding will have on the use of ethanol, biodiesel, and other biomass fuels.

Finally, I have concerns about the administration's 31 percent decrease in funding for fossil energy R&D. I am a strong supporter of investing in renewable fuels, but it is imperative that we develop a balanced energy policy that continues to invest in the clean use of coal. In 2010, President Obama announced his strong support for clean coal technology and committed to establishing at least 10 clean coal demonstration projects by 2016. Further, in August 2010, a multi-agency task force released a report indicating there were no insurmountable roadblocks to deploying carbon capture and storage (CCS) technology on a commercial scale. Despite this support for moving clean coal forward, the FY12 budget cuts funding $100 million from coal R&D and eliminates three ongoing clean coal research programs at DOE.

Coal is and will remain our major energy source for years to come, and we must demonstrate we can cleanly use it. Investing in clean coal now is imperative to continue providing dependable, affordable, and efficient energy while we bring new sources of energy online.

I welcome Secretary Chu, and I look forward to his testimony. Thank you again, Mr. Chairman.

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